IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	§	
TAYLOR *ET AL.*	§	Group Art Unit: **3672**
	§	
Serial No.: **10/787,363**	§	
	§	Examiner: **COY, NICOLE A.**
Filed: **February 26, 2004**	§	
	§	
Title: **"CO_2 MISCIBLE OPTIMIZED HYDROCARBON BLENDS AND METHODS OF USING CO_2 MISCIBLE OPTIMIZED HYDROCARBON BLENDS"**	§	Atty. Docket No: **2003-IP-012051U1**
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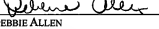

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APPELLANTS' AMENDED BRIEF (37 C.F.R. § 41.37)

Pursuant to 37 C.F.R. § 41.37(d), Applicants file this Amended Brief in response to the Notice of Non-Compliant Appeal Brief mailed on February 27, 2007 (the "Notice"). As this Amended Brief is being submitted within one month of the mailing date of the Notice, this Amended Brief is timely filed.

This Amended Brief is submitted in support of Applicants' Notice of Appeal from the rejections in the Final Office Action dated June 6, 2006 (the "Final Office Action"), the Advisory Action dated August 18, 2006 (the "Advisory Action"), and the Notice of Panel Decision from Pre-Appeal Brief Review dated November 6, 2006.

I. IDENTIFICATION OF THE REAL PARTIES OF INTEREST

The real parties in interest are:

Halliburton Energy Services, Inc.
10200 Bellaire Blvd.
Houston, Texas 77072

and

Chevron U.S.A. Inc.
6001 Bollinger Canyon Road
San Ramon, California 94583-2324

by virtue of assignments by the inventors as duly recorded in the Assignment Branch of the U.S. Patent and Trademark Office.

II. IDENTIFICATION OF RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences, to Applicants' knowledge.

III. STATUS OF THE CLAIMS

The application as originally filed contained 79 claims. Claims 33-79 were previously cancelled. Claims 1-32 are pending.

The Examiner has rejected claims 1-4, 12, 16-20, 28, and 32 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,825,952 to Mzik ("*Mzik*").[1] Applicants disagree with these rejections.

The Examiner also has rejected claims 5, 6, 14, 15, 21, 22, 30, and 31 under 35 U.S.C. § 103(a) as being unpatentable over *Mzik*. Applicants disagree with these rejections.

Further, the Examiner has rejected claims 7-10, 13, 23-26, and 29 under 35 U.S.C. § 103(a) as being unpatentable over *Mzik* in view of U.S. Patent No. 6,511,944 to Taylor *et al.* ("*Taylor*"). Applicants disagree with these rejections.

Finally, the Examiner has rejected claims 11 and 27 under 35 U.S.C. § 103(a) as being unpatentable over *Mzik* in view of U.S. Patent No. 3,954,626 to Greminger, Jr. *et al.* ("*Greminger, Jr.*"). Applicants disagree with these rejections.

Applicants herein appeal the rejections of claims 1-32 as improperly rejected. A listing of all appealed claims is provided in Appendix A in this Amended Brief.

IV. STATUS OF ANY AMENDMENT FILED SUBSEQUENT TO FINAL REJECTION

No amendment has been filed subsequent to final rejection.

[1] A copy of *Mzik* is attached as Appendix E to this Amended Brief.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

Applicants' invention relates to servicing fluids for use in subterranean operations. (*See* Specification at page 4, ll. 1-2.)[2] More particularly, Applicants' invention relates to improved servicing fluids comprising optimized hydrocarbon blends and carbon dioxide and methods of using such servicing fluids in subterranean formations. (*See* Specification at page 4, ll. 2-4.)

Certain embodiments of Applicants' invention provide methods of treating a subterranean formation. These methods comprise the steps of: providing a servicing fluid comprising carbon dioxide and a hydrocarbon blend, wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}); and placing the servicing fluid into the subterranean formation. (*See* Specification at page 4, ll. 5-9; *id.* at page 5, ll. 8-10; claim 1.) In certain embodiments, the hydrocarbon blend comprises at least about 65% hydrocarbons having from seven carbons (C_7) to ten carbons (C_{10}). (*See* Specification at page 6, ll. 23-25; claim 2.) In certain embodiments, about 85% of the hydrocarbon blend comprise hydrocarbons having eight carbons (C_8), hydrocarbons having nine carbons (C_9), or a mixture of hydrocarbons having eight carbons (C_8) and hydrocarbons having nine carbons (C_9). (*See* claim 3.)

Other embodiments of Applicants' invention provide methods of fracturing a subterranean formation. These methods comprise the step of placing a fracturing fluid comprising carbon dioxide and a hydrocarbon blend into the subterranean formation at a pressure sufficient to create at least one fracture therein wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}). (*See* Specification at page 4, ll. 10-14; *id.* at page 9, ll. 5-11; claim 17.) In certain embodiments, the hydrocarbon blend comprises at least about 65% hydrocarbons having from seven carbons (C_7) to ten carbons (C_{10}). (*See* Specification at page 6, ll. 23-25; claim 18.) In certain embodiments, about 85% of the hydrocarbon blend comprise hydrocarbons having eight carbons (C_8), hydrocarbons having nine carbons (C_9), or a mixture of hydrocarbons having eight carbons (C_8) and hydrocarbons having nine carbons (C_9). (*See* claim 19.)

[2] A copy of the specification as filed is provided in Appendix D to this Amended Brief.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The Examiner has rejected claims 1-4, 12, 16-20, 28, and 32 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,825,952 to Mzik. Applicants disagree with these rejections as improper.

The Examiner also has rejected claims 5, 6, 14, 15, 21, 22, 30, and 31 under 35 U.S.C. § 103(a) as being unpatentable over *Mzik*. Applicants disagree with these rejections as improper.

Further, the Examiner has rejected claims 7-10, 13, 23-26, and 29 under 35 U.S.C. § 103(a) as being unpatentable over *Mzik* in view of U.S. Patent No. 6,511,944 to Taylor *et al.* Applicants disagree with these rejections as improper.

Finally, the Examiner has rejected claims 11 and 27 under 35 U.S.C. § 103(a) as being unpatentable over *Mzik* in view of U.S. Patent No. 3,954,626 to Greminger, Jr. *et al.* Applicants disagree with these rejections as improper.

VII. ARGUMENTS

A. *Mzik* cannot anticipate claims 1-4, 12, 16-20, 28, and 32 because *Mzik* only discloses broad ranges of hydrocarbon concentrations, not the specific concentration ranges required in those claims.

In the Final Office Action, the Examiner rejected claims 1-4, 12, 16-20, 28, and 32 under 35 U.S.C. § 102(b) as being anticipated by *Mzik*.

Anticipation can be established only when every element of the claim is disclosed by a single prior art reference. MANUAL OF PATENT EXAMINING PROCEDURE § 2131 (2005) (hereinafter "MPEP"); *RCA Corp. v. Applied Digital Data Systems, Inc*, 730 F.2d 1440, 1444, 221 USPQ 385, 388 (Fed. Cir. 1984). Moreover, when a prior art reference discloses a numerical range that touches or overlaps the claimed range, the reference must disclose the claimed range with "sufficient specificity to constitute an anticipation under the statute." MPEP at § 2131.03 (II).

This question of "sufficient specificity" is fact dependent, and is similar to that of whether a person of ordinary skill in the art could "clearly envisage" a species from a generic teaching. *Id.*; *see id.* at § 2131.02; *In re Petering*, 301 F.2d 676 (CCPA 1962) (disclosure of a generic chemical formula, without more, cannot anticipate a specific compound having that formula where "the generic formula encompasse[s] a vast number and perhaps even an infinite number of compounds"). In the context of numerical ranges, "[i]f the claims are directed to a

narrow range, the reference teaches a broad range, and there is evidence of unexpected results within the claimed narrow range, depending on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with 'sufficient specificity' to constitute an anticipation of the claims." MPEP at § 2131.03 (II). For example, in *Atofina v. Great Lakes Chem. Corp.*, the Federal Circuit refused to find that a prior art reference disclosing a temperature range of 100-500°C anticipated a claimed range of 330-450°C, reasoning that "the disclosure of a range is no more a disclosure of the end points of the range than it is each of the intermediate points." 441 F.3d 991, 999-1000, 78 USPQ2d 1417, 1423-24 (Fed. Cir. 2006). These rules in the Manual of Patent Examining Procedure and clear precedent require the reversal of the Examiner's rejections of these claims.

1. *Mzik* does not teach the concentrations of hydrocarbons required in independent claims 1 and 17 with any specificity.

Independent claims 1 and 17, from which claims 2-4, 12, 16, 18-20, 28, and 32 depend, require that the servicing fluid comprise a hydrocarbon blend that comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}). The rejections of claims 1-4, 12, 16-20, 28, and 32 under 35 U.S.C. § 102(b) should be reversed because *Mzik* does not disclose hydrocarbon blends comprising at least about 65% of C_6-C_{11} hydrocarbons with "sufficient specificity to constitute an anticipation under the statute." MPEP at § 2131.03 (II).

The portions of *Mzik* cited by the Examiner discuss the following:

> A fracturing fluid in the form of a mixture of liquid carbon dioxide and a liquid hydrocarbon component of specific characteristics is injected down the wellbore under pressure to cause fracturing. The hydrocarbon component contains at least 70 wt. % of C_5-C_{14} constituents and at least 8 wt. % aromatics and has an average molecular mass of less than 200, a pour point of less than –40° C. and a density of from 0.77 to 0.85 g/ml at 15° C. This hydrocarbon component provides a higher viscosity than the liquid carbon dioxide at lower temperatures and is also an excellent solvent, simplifying clean-up.
>
> ****
>
> The liquid carbon dioxide and hydrocarbon component can be combined in widely varying proportions, but will usually be in the proportions of about 95 to 15 vol. % liquid carbon dioxide to 5 to 85 vol. % hydrocarbon component.

(*Mzik* at Abstract; *id.* at col. 2, ll. 34-38.) However, this does not specify any particular concentration of C_6-C_{11} hydrocarbons, much less does it disclose concentrations of those hydrocarbons of at least about 65%, as independent claims 1 and 17 recite. The hydrocarbon components comprising at least 70% of C_5-C_{14} hydrocarbons discussed in *Mzik* could comprise a large number of different concentrations of C_6-C_{11} hydrocarbons that may be above or below 65%. Indeed, the Examiner does not assert that *Mzik* specifically teaches concentrations of C_6-C_{11} hydrocarbons of at least about 65%, but rather asserts that *Mzik* anticipates this range by teaching a range of possible hydrocarbon concentrations that encompasses, but is broader than, the range recited in Applicants' claims. (*See* Final Office Action at page 7.) The Final Office Action asserts that, "[a]bsent showing of unexpected results within the claimed range, the Examiner finds that *Mzik* discloses the claimed range with sufficient specificity." *Id.*

In their response to the Final Office Action, Applicants submitted the Declaration of Gary P. Funkhouser ("Declaration") demonstrating unexpected results within the narrower range of C_6-C_{11} hydrocarbon concentrations recited in their claims.[3] Specifically, the Declaration provided calculated data showing that the hydrocarbon blends recited in Applicants' claims would have unexpectedly-higher bubble point pressures than those disclosed by *Mzik* that have C_6-C_{11} hydrocarbon concentrations outside the ranges recited in Applicants' claims, and thus will exhibit higher levels of volatility than those disclosed in *Mzik*. (*See* Declaration at pages 2-3.) Nevertheless, the Examiner maintained his erroneous position in an Advisory Action, asserting that the Declaration does not demonstrate unexpected results within Applicants' claimed concentration ranges because: "(1) the declaration is not comparing the prior art; (2) Example A [in the Declaration] does not appear to be the composition as claimed; and (3) Both Mixtures A and B in the declaration read on the composition of claim 1." (Advisory Action at page 2.) Each of these three assertions by the Examiner are incorrect.

First, the Declaration does compare the hydrocarbon blends taught in *Mzik* to those taught in Applicants' claims. *Mzik* discloses hydrocarbon blends that comprise at least 70% C_5-C_{14} hydrocarbons, which may be "obtained by blending of petroleum products of light and intermediate distillates," including kerosine. (*See Mzik* at col. 2, ll. 12-29.) Example A in the Declaration is based on the testing of a kerosine surrogate that comprises at least 70% of C_5-C_{14} hydrocarbons, which falls within the range disclosed in *Mzik*. Next, the Examiner is correct

[3] A copy of this Declaration is provided in Appendix B to this Amended Brief.

that Example A is not the composition recited in Applicants' claims; rather, Example A illustrates the properties of the hydrocarbon blends disclosed in *Mzik* that do not fall within the scope of Applicants' claims, for comparison with hydrocarbon blends that do fall within the scope of Applicants' claims (*e.g.*, Example B). Finally, contrary to the Advisory Action's assertion, Mixture A does not read on the compositions recited in Applicants' claims. Mixture A comprises 20% of dodecane ($C_{12}H_{25}$), 15% of tetradecane ($C_{14}H_{30}$), and 10% hexadecane ($C_{16}H_{34}$). (*See* Declaration at page 2.) Thus, since these components that are larger than C_{11} comprise 45% of Mixture A, Mixture A cannot comprise at least 65% of C_6-C_{11} hydrocarbons. Thus, the Declaration properly compares examples of hydrocarbon blends disclosed in *Mzik* (*e.g.*, Example A) and examples of those within the scope of Applicants' claims (*e.g.*, Example B), and shows that those described by the narrower concentration ranges recited in Applicants' claims exhibit unexpected volatility properties as compared with those generically described in *Mzik* that fall outside the claimed ranges. In view of these unexpected properties, similar to the disclosure of the prior art in *Atofina*, *Mzik's* disclosure of a broad ranges of hydrocarbon concentrations "is no more a disclosure of the end points of the range" than it is of the narrower concentration ranges recited in claims 1 and 17. Thus, *Mzik* cannot anticipate Applicants' claims.

Therefore, Applicants respectfully submit that independent claims 1 and 17 are patentable over *Mzik*. Moreover, since "a claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers," and since claims 2-4, 12, 16, 18-20, 28, and 32 depend, either directly or indirectly, from claim 1 or 17, these dependent claims are allowable for at least the same reasons. *See* 35 U.S.C. § 112 ¶ 4 (2004). Accordingly, Applicants respectfully request the reversal of these rejections.

2. *Mzik* does not disclose the further-narrowed concentrations of hydrocarbons required in dependent claims 2, 3, 18, and 19.

Dependent claims 2, 3, 18, and 19 further narrow the concentrations of certain hydrocarbons from those required by independent claims 1 and 17. Claims 2 and 18 require that the hydrocarbon blend comprise at least about 65% hydrocarbons having from seven carbons (C_7) to ten carbons (C_{10}). Claims 3 and 19 require that about 85% of the hydrocarbon blend comprise hydrocarbons having eight carbons (C_8), hydrocarbons having nine carbons (C_9), or a mixture of hydrocarbons having eight carbons (C_8) and hydrocarbons having nine carbons (C_9). The rejections of claims 2, 3, 18, and 19 under 35 U.S.C. § 102(b) should be reversed because, in

addition to the reasons discussed above with respect to independent claims 1 and 17, *Mzik* does not disclose hydrocarbon blends either (1) comprising at least about 65% C_7-C_{10} hydrocarbons or (2) wherein about 85% of the hydrocarbon blend comprises C_8 hydrocarbons, C_9 hydrocarbons, or a mixture of C_8 and C_9 hydrocarbons with "sufficient specificity to constitute an anticipation under the statute." MPEP at § 2131.03 (II); *see Atofina*, 441 F.3d at 999-1000, 78 USPQ2d at 1423-24.

As discussed in Section VII.A.1. above, *Mzik* only discloses a concentration for C_5-C_{14} hydrocarbons hydrocarbons in an amount of at least 70% (*see Mzik* at Abstract), which may or may not fall within the ranges recited in claims 2, 3, 18, and 19. Thus, just as this generic disclosure in *Mzik* does not disclose concentrations of C_6-C_{11} hydrocarbons of at least about 65%, nor does it disclose the even narrower sets of hydrocarbon blends comprising at least about 65% C_7-C_{10} hydrocarbons or about 85% C_8 hydrocarbons, C_9 hydrocarbons, or a mixture of C_8 and C_9 hydrocarbons with "sufficient specificity" to anticipate the claims reciting those concentrations.

Therefore, Applicants respectfully submit that claims 2, 3, 18, and 19 are patentable over *Mzik*. Accordingly, Applicants respectfully request the reversal of these rejections.

B. *Mzik* cannot obviate claims 5, 6, 14, 15, 21, 22, 30, and 31 because the Examiner has failed to establish a *prima facie* obviousness case against these claims, and Applicants have presented sufficient evidence to rebut any such claim of obviousness.

In the Final Office Action, the Examiner rejected claims 5, 6, 14, 15, 21, 22, 30, and 31 under 35 U.S.C. § 103(a) as unpatentable over *Mzik*. Claims 5, 6, 14, 15, 21, 22, 30, and 31 depend from one of independent claims 1 or 17, and further narrow the concentrations of certain hydrocarbons from those required by the independent claims. Claims 5 and 21 require that the hydrocarbon blend comprise less than about 1% of hydrocarbons larger than C_{10}. Claims 6 and 22 require that the hydrocarbon blend comprise less than about 1% of hydrocarbons smaller than C_7. Claims 14 and 30 require that the hydrocarbon blend comprise less than about 1% of hydrocarbons smaller than C_7, about 5% C_7 hydrocarbons, about 44% C_8 hydrocarbons, about 43% C_9 hydrocarbons, about 8% C_{10} hydrocarbons, and less than about 1% of hydrocarbons larger than C_{10}. Claims 15 and 31 require all of the requirements of claims 14 and 30, respectively, and further require that the hydrocarbon blend comprises substantially no

hydrocarbons larger than C_{11}. The rejections of claims 5, 6, 14, 15, 21, 22, 30, and 31 under 35 U.S.C. § 103(a) should be reversed because: (1) *Mzik* does not teach the concentrations of hydrocarbons required in claims 1 and 17, from which these claims depend; (2) the optimization of the hydrocarbon concentrations recited in claims 5, 6, 14, 15, 21, 22, 30, and 31 cannot be obvious since *Mzik* does not recognize those concentrations as "result-effective variables"; (3) the requirement in claims 15 and 31 that the hydrocarbon blend comprise substantially no hydrocarbons larger than C_{11} would not be an obvious optimization in view of *Mzik*; and (4) the unexpected properties of Applicants' claimed hydrocarbon blends indicate that optimization to those blends would not be "routine experimentation."

1. *Mzik* does not teach the concentrations of hydrocarbons required in claims 1 and 17, from which all of the rejected claims depend.

The Examiner has rejected claims 5, 6, 14, 15, 21, 22, 30, and 31 under 35 U.S.C § 103(a) as being unpatentable over *Mzik* based in part on the assertion that *Mzik* teaches the requirement recited in claims 1 and 17 that the hydrocarbon blend comprise at least about 65% of C_6-C_{11} hydrocarbons that is incorporated into dependent claims 5-11, 13-15, 21-27, and 29-31. (*See* Final Office Action, at pages 3-7.) To form a basis for a § 103(a) rejection, a prior art reference must teach or suggest each element in the claim. MPEP at § 2143.03. However, as discussed in Section VII.A.1. above, *Mzik* does not teach or suggest a hydrocarbon blend that "comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11})." Since claims 5, 6, 14, 15, 21, 22, 30, and 31 depend, directly or indirectly, from claim 1 or 17, these dependent claims include the limitations of claims 1 and 17 that *Mzik* does not teach or suggest. Therefore, claims 5, 6, 14, 15, 21, 22, 30, and 31 are allowable over *Mzik*. Accordingly, Applicants respectfully request the reversal of these rejections.

2. *Mzik* fails to recognize the concentrations of hydrocarbons as a "result-effective variable."

The rejections of claims 5, 6, 14, 15, 21, 22, 30, and 31 under 35 U.S.C § 103(a) over *Mzik* rely on the additional premise that, although *Mzik* does not specifically teach the optimized hydrocarbon concentrations recited in those claims, such optimization would be routine experimentation for a person of skill in the art, and thus those claims are obvious in view of *Mzik*. (*See* Final Office Action at pages 9-11.)

However, before the determination of optimum or workable ranges of certain variables can be considered "routine experimentation," "a particular parameter must be first

recognized as a result-effective variable, *i.e.*, a variable which achieves a recognized result." MPEP at § 2144.05 (II.B.) (emphasis added) (section entitled *"Only Result-Effective Variables Can Be Optimized"*); *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). As Applicants noted in their response to the Final Office Action, the Examiner has cited nothing in *Mzik* or any other prior art reference to show that a person of ordinary skill in the art would have recognized the parameters being optimized (*i.e.*, the concentrations of the different sizes of hydrocarbons recited in claims 5, 6, 14, 15, 21, 22, 30, and 31, or those recited in independent claims 1 and 17, from which these claims depend) as result-effective variables. The Examiner asserts that "the burden is not on the prior art reference to show that a claimed range achieves a particular result," and that Applicants have failed to rebut the obviousness rejection by showing the criticality of the ranges recited in their claims. (*See, e.g.*, Final Office Action at page 9.) To the contrary, clear precedent and the Manual of Patent Examining Procedure unequivocably require that the result-effectiveness of the claimed variable be recognized in the prior art. MPEP at § 2144.05 (II.B.); *In re Antonie*, 559 F.2d at 618, 195 USPQ at 6 (obviousness rejection reversed where prior art did not recognize that parameter defined in the claim was a result-effective variable). The Board of Patent Appeals and Interferences has applied this rule repeatedly to overturn rejections under § 103(a) where the Examiner rejected claims directed to optimization of ranges for certain variables and parameters where those variables and parameters were not recognized as "result-effective" in the prior art.[4] Only once the Examiner establishes this element of the

[4] *See, e.g.*, *Ex parte* Lanzendorfer *et al.*, Appeal No. 2006-1383, 2006 WL 2558175, at *2 (Bd. Pat. App. & Interf.); *Ex parte* Che *et al.*, Appeal No. 2005-0178, 2005 WL 4773740, at *4 (Bd. Pat. App. & Interf. Feb. 9, 2005); *Ex parte* Ferber *et al.*, Appeal No. 2004-1622, 2004 WL 4983375, at *3 (Bd. Pat. App. & Interf. Dec. 9, 2004) (obviousness rejection reversed where prior art failed to mention or "attach any importance to" the claimed variable, conclusion of obviousness would require "impermissible hindsight"); *Ex parte* Dornfeld *et al.*, Appeal No. 2002-1029, 2004 WL 4972873, at *2 (Bd. Pat. App. & Interf. Sept. 30, 2004) (reversing obviousness rejection where rejected claim required frequency above 50,000 Hz but prior art only disclosed "frequencies above about 20,000 Hz", claimed range not obvious optimization); *Ex parte* Cornell *et al.*, Appeal No. 2001-0059, 2006 WL 2523874, at *2 (Bd. Pat. App. & Interf. Dec. 23, 2002); *Ex parte* Sicking *et al.*, Appeal No. 2000-0523, 2001 WL 1057283, at *4 (Bd. Pat. App. & Interf.); *Ex parte* Nikkel *et al.*, Appeal No. 1999-1718, 2001 WL 1149824, at *3 (Bd. Pat. App. & Interf.); *Ex parte* Peng, Appeal No. 1999-0037, 2001 WL 1339925, at *4 (Bd. Pat. App. & Interf.) ("Recognition of [result-effectiveness of the claimed variable] is essential to the obviousness of conducting experiments to decide the [values for the variable] that will offer an acceptable [result]"). (Copies of these opinions are provided in Appendix F to this Amended Brief.) Although the opinions issued in these cases are not binding precedent, they clearly demonstrate the proper analysis for determining whether optimization of a claimed variable is obvious under § 103(a).

prima facie obviousness case should Applicants be required to rebut the Examiner's assertion that the optimization of that variable is obvious.[5]

Thus, the rejections of claims 5, 6, 14, 15, 21, 22, 30, and 31 under § 103(a), as well as any rejections of claims 1-32 under § 103(a) that rely on this rationale to modify or optimize the hydrocarbon blends taught in *Mzik*, are improper. Accordingly, Applicants respectfully request the withdrawal of these rejections.

3. *Mzik* virtually teaches away from the requirement in claims 15 and 31 that the hydrocarbon blend comprise substantially no hydrocarbons larger than C_{11}.

Claims 15 and 31 specifically require that the hydrocarbon blend comprise substantially no hydrocarbons larger than C_{11}. In order for this requirement to be an obvious optimization of the hydrocarbon blends described in *Mzik*, the prior art must suggest the desirability of a hydrocarbon blend comprise substantially no hydrocarbons larger than C_{11}. *See* MPEP at § 2143.01. However, not only does *Mzik* not recognize this variable as result-effective or desirable to adopt, *Mzik* actually suggests just the opposite with respect to hydrocarbons larger than C_{11}. *Mzik* affirmatively teaches that the hydrocarbons included in the hydrocarbon component of the fluids described therein may have as many as 14 carbons (C_{14}), which claims 15 and 31 expressly preclude. (*See Mzik* at Abstract.) Thus, the only teaching in *Mzik* regarding the presence of hydrocarbons larger than C_{11} provides no suggestion or motivation to exclude substantial concentrations of those hydrocarbons, as claims 15 and 31 require, and arguably teaches away from their exclusion. Accordingly, Applicants respectfully submit that *Mzik* cannot obviate claims 15 and 31, and respectfully request the reversal of these rejections.

4. Unexpected properties of Applicants' claimed hydrocarbon blends rebut the assertion that those blends would be obvious.

Finally, as the Examiner noted in the Final Office Action, an applicant can rebut a presumption of obviousness based on a claimed range that falls within a prior art range by showing "that there are new and unexpected results relative to the prior art." MPEP at § 2144.05 (III.); *Iron Grip Barbell Co., Inc. v. USA Sports, Inc.*, 392 F.3d 1317, 1322, 73 USPQ2d 1225, 1228 (Fed. Cir. 2004).

[5] *See Ex parte Nikkel et al.*, 2001 WL 1149824, at *3 (reversing § 103(a) rejection where prior art failed to recognize claimed variable as result-effective, noting that "it matters not that the record is lacking in proof that the claimed [variable range] is critical or provides new and unexpected results.")

Applicants have presented evidence of the unexpected results and properties of the hydrocarbon blends recited in their claims to rebut these obviousness rejections. As discussed in Section VII.A.1. above and in Applicants' response to the Final Office Action, the calculated data in the Declaration of Gary P. Funkhouser indicate that the hydrocarbon blends generically disclosed by *Mzik* may have much lower bubble points, and thus will not exhibit the same level of volatility as the specific set of hydrocarbon blends recited in Applicants' claims. (*See* Response to Final Office Action at page 9.) These unexpected properties clearly rebut the Examiner's assertions that the concentrations of certain hydrocarbons recited in Applicants' claims are obvious optimizations. As discussed above, each of the Examiner's reasons for asserting that this Declaration fails to demonstrate the criticality of the claimed ranges are either incorrect or irrelevant. Thus, the rejections of claims 5, 6, 14, 15, 21, 22, 30, and 31 under § 103(a), as well as any rejections of claims 1-32 under § 103(a) that rely on this rationale to modify or optimize the hydrocarbon blends taught in *Mzik*, are improper. Accordingly, Applicants respectfully request the withdrawal of these rejections.

C. *Mzik* in view of *Taylor* does not obviate claims 7-10, 13, 23-26, and 29.

The Examiner has rejected claims 7-10, 13, 23-26, and 29 under 35 U.S.C § 103(a) as being unpatentable over *Mzik* in view of *Taylor* based in part on the assertion that *Mzik* teaches the requirement recited in claims 1 and 17 that the hydrocarbon blend comprise at least about 65% of C_6-C_{11} hydrocarbons that is incorporated into dependent claims 7-10, 13, 23-26, and 29. (*See* Final Office Action, at pages 3-7.) To form a basis for a § 103(a) rejection, a prior art reference must teach or suggest each element in the claim. MPEP at § 2143.03; *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). However, as discussed in Section VII.A.1. above, *Mzik* does not teach or suggest a hydrocarbon blend that "comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11})." Nor does *Taylor* supply this element, as *Taylor* teaches gelled hydrocarbon liquids generally, but does not discuss the compositions of those fluids with respect to the size of the hydrocarbons therein. (*See Taylor* at col. 4, ll. 27-37.) Since claims 7-10, 13, 23-26, and 29 depend, directly or indirectly, from claim 1 or 17, these dependent claims include the limitations of claims 1 and 17 that neither *Mzik* nor *Taylor* teaches or suggests. MPEP at § 2143.03 ("If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious."); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, claims 7-10, 13, 23-26, and 29 are allowable over

the combination of *Mzik* and *Taylor*. Accordingly, Applicants respectfully request the reversal of these rejections.

D. *Mzik* in view of *Greminger, Jr.* does not obviate claims 11 and 27.

The Examiner has rejected claims 11 and 27 under 35 U.S.C § 103(a) as being unpatentable over *Mzik* in view of *Greminger, Jr.* based in part on the assertion that *Mzik* teaches the requirement recited in claims 1 and 17 that the hydrocarbon blend comprise at least about 65% of C_6-C_{11} hydrocarbons that is incorporated into dependent claims 11 and 27. (*See* Final Office Action, at pages 3-7.) To form a basis for a § 103(a) rejection, a prior art reference must teach or suggest each element in the claim. MPEP at § 2143.03; *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). However, as discussed in Section VII.A.1. above, *Mzik* does not teach or suggest a hydrocarbon blend that "comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11})." Nor does *Greminger, Jr.* supply this element, as *Greminger, Jr.* only teaches the use of fracturing fluids that comprise liquid carbon dioxide, an anhydrous alcohol, and a hydroxypropyl methylcellulose, but does not discuss the compositions of those fluids with respect to the size of the hydrocarbons therein. (*See Greminger, Jr.* at Abstract.) Since claims 7-10, 13, 23-26, and 29 depend, directly or indirectly, from claim 1 or 17, these dependent claims include the limitations of claims 1 and 17 that neither *Mzik* nor *Greminger, Jr.* teaches or suggests. MPEP at § 2143.03 ("If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious."); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, claims 7-10, 13, 23-26, and 29 are allowable over the combination of *Mzik* and *Greminger, Jr.* Accordingly, Applicants respectfully request the reversal of these rejections.

VIII. SUMMARY

In light of the foregoing, Applicants respectfully request that the final rejection of the pending claims should be reversed and the application be remanded for allowance of the pending claims, or, alternatively, remand the application for further examination if appropriate references can be found by the Examiner.

Applicants petitioned under the provisions of 37 C.F.R § 1.136(a) for a one-month extension of time to file their original Appellants' Brief, up to and including January 6, 2007, and filed that Brief on January 4, 2007. Thus, that Brief was timely filed. As this

Amended Brief is being submitted within one month of the mailing date of the Notice of Non-Compliant Appeal Brief, this Amended Brief is timely filed.

Applicants believe that there are no fees due in association with filing this Amended Brief. However, should the Commissioner deem that any additional fees are due, including any fees for extensions of time, the Commissioner is authorized to debit Baker Botts L.L.P.'s Deposit Account No. 02-0383, Order Number 063718.0382.

Respectfully submitted,

Elizabeth L. Durham
Registration No. 59,509
BAKER BOTTS L.L.P.
One Shell Plaza
910 Louisiana
Houston, TX 77002
Telephone: 713.229.2104
Facsimile: 713.229.7704
Email: liz.durham@bakerbotts.com

Date: March 19, 2007

APPENDIX A: CLAIMS INVOLVED IN APPEAL

1. (Original) A method of treating a subterranean formation comprising the steps of:

providing a servicing fluid comprising carbon dioxide and a hydrocarbon blend, wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}); and

placing the servicing fluid into the subterranean formation.

2. (Original) The method of claim 1 wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from seven carbons (C_7) to ten carbons (C_{10}).

3. (Original) The method of claim 1 wherein about 85% of the hydrocarbon blend comprises hydrocarbons having eight carbons (C_8), hydrocarbons having nine carbons (C_9), or a mixture of hydrocarbons having eight carbons (C_8) and hydrocarbons having nine carbons (C_9).

4. (Original) The method of claim 1 wherein the hydrocarbon blend has a Reid Vapor pressure below about 2 psi.

5. (Original) The method of claim 1 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having more than ten carbons (C_{10}).

6. (Original) The method of claim 1 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7).

7. (Original) The method of claim 1 wherein the servicing fluid further comprises a gelling agent present in an amount in the range of from about 0.1% to about 2.5% by weight of the hydrocarbon blend.

8. (Previously Presented) The method of claim 7 wherein the gelling agent is selected from the group consisting of ferric iron polyvalent metal complexes of alkylphosphonic acid esters, aluminum polyvalent metal complexes of alkylphosphonic acid esters, and combinations thereof.

9. (Previously Presented) The method of claim 7 wherein the gelling agent is selected from the group consisting of ferric iron polyvalent metal complexes of orthophosphoric acid esters, aluminum polyvalent metal complexes of orthophosphoric acid esters, and combinations thereof.

10. (Previously Presented) The method of claim 7 wherein the gelling agent is selected from the group consisting of ferric iron polyvalent metal complexes of unsymmetrical

dialkylphosphinic acids, aluminum polyvalent metal complexes of unsymmetrical dialkylphosphinic acids, and combinations thereof.

11. (Original) The method of claim 1 wherein the servicing fluid further comprises a LPG fluid.

12. (Original) The method of claim 1 wherein the servicing fluid further comprises particulates.

13. (Original) The method of claim 1 wherein the servicing fluid further comprises a delayed gel breaker.

14. (Original) The method of claim 1 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7), about 5% hydrocarbons having seven carbons (C_7); about 44% hydrocarbons having eight carbons (C_8); about 43% hydrocarbons having nine carbons (C_9); about 8% hydrocarbons having ten carbons (C_{10}); and less than about 1% hydrocarbons having more than ten carbons (C_{10}).

15. (Original) The method of claim 14 wherein the hydrocarbon blend comprises substantially no hydrocarbons having more than eleven carbons (C_{11}).

16. (Original) The method of claim 1 wherein the servicing fluid comprises from about 30 volume % to about 80 volume % carbon dioxide by volume of hydrocarbon blend.

17. (Original) A method of fracturing a subterranean formation comprising the step of placing a fracturing fluid comprising carbon dioxide and a hydrocarbon blend into the subterranean formation at a pressure sufficient to create at least one fracture therein wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}).

18. (Original) The method of claim 17 wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from seven carbons (C_7) to ten carbons (C_{10}).

19. (Original) The method of claim 17 wherein about 85% of the hydrocarbon blend comprises hydrocarbons having eight carbons (C_8), hydrocarbons having nine carbons (C_9), or a mixture of hydrocarbons having eight carbons (C_8) and hydrocarbons having nine carbons (C_9).

20. (Original) The method of claim 17 wherein the hydrocarbon blend has a Reid Vapor pressure below about 2 psi.

21. (Original) The method of claim 17 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having more than 10 carbons (C_{10}).

22. (Original) The method of claim 17 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7).

23. (Original) The method of claim 17 wherein the fracturing fluid further comprises a gelling agent present in an amount in the range of from about 0.1% to about 2.5% by weight of the hydrocarbon blend.

24. (Previously Presented) The method of claim 23 wherein the gelling agent is selected from the group consisting of ferric iron polyvalent metal complexes of alkylphosphonic acid esters, aluminum polyvalent metal complexes of alkylphosphonic acid esters, and combinations thereof.

25. (Previously Presented) The method of claim 23 wherein the gelling agent is selected from the group consisting of ferric iron polyvalent metal complexes of orthophosphoric acid esters, aluminum polyvalent metal complexes of orthophosphoric acid esters, and combinations thereof.

26. (Previously Presented) The method of claim 23 wherein the gelling agent is selected from the group consisting of ferric iron polyvalent metal complexes of unsymmetrical dialkylphosphinic acids, aluminum polyvalent metal complexes of unsymmetrical dialkylphosphinic acids, and combinations thereof.

27. (Original) The method of claim 17 wherein the fracturing fluid further comprises a LPG fluid.

28. (Original) The method of claim 17 wherein the fracturing fluid further comprises particulates.

29. (Original) The method of claim 17 wherein the fracturing fluid further comprises a delayed gel breaker.

30. (Original) The method of claim 17 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7), about 5% hydrocarbons having seven carbons (C_7); about 44% hydrocarbons having eight carbons (C_8); about 43% hydrocarbons having nine carbons (C_9); about 8% hydrocarbons having ten carbons (C_{10}); and less than about 1% hydrocarbons having more than ten carbons (C_{10}).

31. (Original) The method of claim 30 wherein the hydrocarbon blend comprises substantially no hydrocarbons having more than eleven carbons (C_{11}).

32. (Original) The method of claim 17 wherein the servicing fluid comprises from about 30 volume % to about 80 volume % carbon dioxide.

APPENDIX B: EVIDENCE

Contents:

1. Declaration of Gary P. Funkhouser

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	§	
TAYLOR *ET AL.*	§	Group Art Unit: 3672
	§	
Serial No.: 10/787,363	§	
	§	Examiner: COY, NICOLE A.
Filed: February 26, 2004	§	
	§	
Title: "CO_2 MISCIBLE OPTIMIZED HYDROCARBON BLENDS AND METHODS OF USING CO_2 MISCIBLE OPTIMIZED HYDROCARBON BLENDS"	§	Atty. Docket No: 2003-IP-012051U1
	§	
	§	

CERTIFICATE OF MAILING

SERIAL NO.: 10/787,363
ATTY. DOCKET NO.: 2003-IP-012051U1
GROUP ART UNIT: 3672
EXAMINER: NICOLE A. COY

PURSUANT TO 37 C.F.R. § 1.10, I HEREBY CERTIFY THAT I HAVE INFORMATION AND A REASONABLE BASIS FOR BELIEF THAT THIS CORRESPONDENCE WILL BE DEPOSITED WITH THE UNITED STATES POSTAL SERVICE AS EXPRESS MAIL, POST OFFICE TO ADDRESSEE, ON THE DATE INDICATED BELOW, AND IS ADDRESSED TO:

MAIL STOP AF
HONORABLE COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450.

TAMMY KNIGHT — DATE 8/4/06

EXPRESS MAIL LABEL: EQ726817802US

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P.O. Box 1450
Alexandria, Va 22313-1450

DECLARATION OF GARY P. FUNKHOUSER UNDER 37 C.F.R. § 1.132

1. My name is Gary P. Funkhouser. I am over the age of 21 years, of sound mind, and competent in all respects to make this Declaration. I am a co-inventor in the above-identified patent application.

2. I performed an experiment according to the following procedure:

a. I calculated the bubble point pressures for two different hydrocarbon mixtures using the NIST Standard Reference Database 4, Thermophysical Properties of Hydrocarbon Mixtures Database (SUPERTRAPP), Version 2.01.

b. Hydrocarbon Mixture A was a kerosine surrogate composition that consisted of the following blend of hydrocarbons:

Component - Hydrocarbon Mixture A	**Wt%**
isooctane	5
methylcyclohexane	5
m-xylene	5
1,1,2-trimethylcyclohexane	5
decane	15
butylbenzene	5
1,2,4,5-tetramethylbenzene	5
cis-decalin	5
dodecane	20
1-methylnaphthalene	5
tetradecane	15
hexadecane	10

c. Hydrocarbon Mixture B was a hydrocarbon blend that consisted of the following blend of hydrocarbons:

Component - Hydrocarbon Mixture B	**Wt%**
heptane	25
octane	25
nonane	25
decane	25

d. I calculated the bubble point pressures for these hydrocarbon mixtures at five different temperatures (100°C, 120°C, 130°C, 140°C, and 150°C).

3. The bubble point pressures that I calculated according to the above procedure are given below:

Temp., °C	Bubble point pressures (psi)	
	Hydrocarbon Mixture A	Hydrocarbon Mixture B
100	2.8	7.1
120	5.1	12.8
130	6.5	16.5
140	8.1	21.3
150	10.9	27.1

4. In my opinion, these bubble point pressures indicate that the hydrocarbon blends with compositions similar to those of Hydrocarbon Mixture A will be less volatile than those similar to Hydrocarbon Mixture B.

5. I hereby declare that all statements made herein of my own knowledge are true and that all statements made herein on information and belief are believed to be true. I declare that these statements are made with the knowledge that willful false statements, and the like so made, are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Gary P. Funkhouser

Gary P. Funkhouser

Date: 8-2-2006

APPENDIX C: RELATED PROCEEDINGS

None

APPENDIX D: SPECIFICATION AS FILED

CO_2 MISCIBLE OPTIMIZED HYDROCARBON BLENDS AND METHODS OF USING CO_2 MISCIBLE OPTIMIZED HYDROCARBON BLENDS

BACKGROUND

[0001] The present invention relates to servicing fluids for use in subterranean operations. More particularly, the present invention relates to improved servicing fluids comprising optimized hydrocarbon blends and carbon dioxide and methods of using such servicing fluids in subterranean formations.

[0002] Servicing fluids are used in a variety of operations and treatments performed in oil and gas wells. Such operations and treatments include, but are not limited to, production stimulation operations, such as fracturing, and well completion operations, such as gravel packing.

[0003] An example of a production stimulation operation using a servicing fluid having particles suspended therein is hydraulic fracturing. That is, a type of servicing fluid, referred to in the art as a fracturing fluid, is pumped through a well bore into a subterranean zone to be stimulated at a rate and pressure such that fractures are formed or enhanced in a desired subterranean zone. The fracturing fluid is generally a gel, emulsion, or foam that may comprise a particulate material often referred to as proppant. When used, proppant is deposited in the fracture and functions, *inter alia*, to hold the fracture open while maintaining conductive channels through which such produced fluids can flow upon completion of the fracturing treatment and release of the attendant hydraulic pressure.

[0004] An example of a well completion operation using a servicing fluid having particles suspended therein is gravel packing. Gravel packing treatments are used, *inter alia*, to reduce the migration of unconsolidated formation particulates into the well bore. In gravel packing operations, particulates, referred to in the art as gravel, are carried to a well bore in a subterranean producing zone by a servicing fluid known as a carrier fluid. That is, the particulates are suspended in a carrier fluid, which may be viscosified, and the carrier fluid is pumped into a well bore in which the gravel pack is to be placed. As the particulates are placed in the zone, the carrier fluid leaks off into the subterranean zone and/or is returned to the surface. The resultant gravel pack acts as a filter to separate formation solids from produced fluids while

permitting the produced fluids to flow into and through the well bore. While screenless gravel packing operations are becoming more common, traditional gravel pack operations involve placing a gravel pack screen in the well bore and packing the surrounding annulus between the screen and the well bore with gravel designed to prevent the passage of formation particulates through the pack with produced fluids, wherein the well bore may be oriented from vertical to horizontal and may extend from hundreds to thousands of feet. When installing the gravel pack, the gravel is carried to the formation in the form of a slurry by mixing the gravel with a viscosified carrier fluid. Such gravel packs may be used to stabilize a formation while causing minimal impairment to well productivity. The gravel, *inter alia*, acts to prevent the particulates from occluding the screen or migrating with the produced fluids, and the screen, *inter alia*, acts to prevent the gravel from entering the well bore.

[0005] In some situations the processes of hydraulic fracturing and gravel packing are combined into a single treatment to provide a stimulated production and an annular gravel pack to prevent formation sand production. Such treatments are often referred to as "frac pack" operations. In some cases the treatments are completed with a gravel pack screen assembly in place with the hydraulic fracturing treatment being pumped through the annular space between the casing and screen. In this situation the hydraulic fracturing treatment ends in a screen out condition creating an annular gravel pack between the screen and casing. This allows both the hydraulic fracturing treatment and gravel pack to be placed in a single operation. In other cases the fracturing treatment may be performed prior to installing the screen and placing a gravel pack.

[0006] In carrying out hydraulic fracturing, frac packing, and gravel packing, fluid recovery oftentimes is critical. Foamed fluids have been developed in part to provide enhanced fluid recovery through energization by a compressed gas phase. They also reduce the total amount of liquid used, typically by a factor of about four. Such foamed fluids have included various surfactants, known as foaming and foam stabilizing agents, for facilitating the foaming and stabilization of the foam produced when a gas is mixed with a servicing fluid. Thus, foamed fluids may be thought of as media in which a relatively large volume of gas is dispersed in a relatively small volume of liquid, usually with the aid of a surfactant that reduces the surface tension of the fluid. The most commonly used gases for foamed fracture fluids are nitrogen, carbon dioxide, and/or combinations of the two. Foamed servicing fluids may be preferred over

conventional servicing fluids because they generally provide superior fluid recovery as well as excellent fluid loss control without forming a substantial filter cake. Enhanced fluid recovery is provided by the expansion of the gas in the foam when the pressure is released after the stimulation and/or treatment. This promotes flow of residual servicing fluid liquid back into the well, which may aid in cleanup of the servicing fluid once the subterranean operation is complete.

[0007] The use of conventional servicing fluids in subterranean operations may present disadvantages. For example, high capillary pressures associated with the use of aqueous systems may restrict the flow of produced gaseous hydrocarbons such as methane. Capillary pressures of several thousand psi can result in low permeability formations, wherein the high differential pressures necessary to initiate gas flow can result in extended fluid recovery times, or permanent loss of effective fracture half length. Furthermore, use of water in undersaturated reservoirs can also reduce permeability and associated gas flow through permanent increase in water saturation of the reservoir.

SUMMARY OF THE INVENTION

[0008] The present invention relates to servicing fluids for use in subterranean operations. More particularly, the present invention relates to improved servicing fluids comprising optimized hydrocarbon blends and carbon dioxide and methods of using such servicing fluids in subterranean formations.

[0009] One embodiment of the present invention provides a method of treating a subterranean formation comprising the steps of providing a servicing fluid comprising carbon dioxide and a hydrocarbon blend, wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}); and placing the servicing fluid into the subterranean formation.

[0010] Another embodiment of the present invention provides a method of fracturing a subterranean formation comprising the step of placing a fracturing fluid comprising carbon dioxide and a hydrocarbon blend into the subterranean formation at a pressure sufficient to create at least one fracture therein wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}).

[0011] Still another embodiment of the present invention provides a method of drilling in a subterranean zone comprising the steps of providing a drill-in fluid comprising carbon dioxide and a hydrocarbon blend wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}) and drilling into a formation using the drill-in fluid so as to create a well bore penetrating a producing formation.

[0012] Another embodiment of the present invention provides a subterranean servicing fluid comprising carbon dioxide and a hydrocarbon blend wherein the hydrocarbon blend comprises and at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}).

[0013] Other and further features and advantages of the present invention will be readily apparent to those skilled in the art upon a reading of the description of preferred embodiments which follows.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] The present invention relates to servicing fluids for use in subterranean operations. More particularly, the present invention relates to improved servicing fluids comprising optimized hydrocarbon blends and carbon dioxide and methods of using such servicing fluids in subterranean formations. While the compositions and methods of the present invention may be useful in a variety of applications, they are particularly useful for stimulation and well completion operations, such as, but not limited to, fracturing, gravel packing, frac pack applications, and drill-in operations performed in subterranean wells such as oil and gas wells.

[0015] The improved servicing fluids of the present invention generally comprise carbon dioxide and liquid hydrocarbon blends that comprise at least about 65% hydrocarbons having from six carbons (C_6) through eleven carbons (C_{11}). The hydrocarbon blends that are a component of the servicing fluids of the present invention, are comprised primarily of hydrocarbons of chain length C_{10} or less. In certain embodiments, they are manageable as liquids (at standard conditions of about 60°F and about 1 atmosphere (14.7 psi) pressure) and may be suitable for use with traditional equipment used in subterranean treatments. One advantage of these fluids is that they may exhibit increased volatility versus conventional servicing fluids, which may aid in recovering the fluid from the subterranean formation once the treatment (such as a fracturing, frac packing treatment, gravel pack treatment, or drill-in treatment) is complete. Generally speaking, the more volatile the hydrocarbon based servicing fluid, the greater the rate and completeness of fluid recovery. However, use of too volatile a servicing fluid may be impractical and may present a safety hazard. One advantage of the present invention is in providing an optimized hydrocarbon blend that provides enhanced volatility, while remaining safe to handle and pump with conventional equipment.

[0016] The carbon dioxide added to the hydrocarbon-based servicing fluids of the present invention acts, *inter alia*, to increase the rate of the servicing fluid's recovery from the subterranean formation. However, increasing concentrations of dissolved carbon dioxide in the liquid hydrocarbon make it progressively more difficult to gel with phosphate ester and alkylphosphonic acid ester gel systems. As a result there is a limit to the concentration of carbon dioxide that may be present in the servicing fluids. For instance, if too high a concentration of carbon dioxide is present, the servicing fluid may not have a viscosity sufficient to carry the needed quantity of particulates to a desired location within a well bore, to adequately control

fluid leak off, and to generate the desired fracture geometry. In some embodiments of the present invention, the servicing fluid comprises from about 20 volume % to about 80 volume % carbon dioxide. Other embodiments of the present invention comprise from about 30 volume % to about 50 volume % carbon dioxide. It is within the ability of one skilled in the art, with the benefit of this disclosure, to determine the proper amount of carbon dioxide to add to the total servicing fluid.

[0017] The servicing fluids of the present invention may be particularly useful in low permeability formations, low reservoir pressure formations, and formations containing water-sensitive clays. When such formations are fractured with aqueous servicing fluids, high capillary pressure may result that may cause either slow fluid recovery or result in water blockage. Water blockage and, to a lesser extent, less than optimal fluid recovery may result in a loss of effective fracture length and, thus, may reduce the benefits of the fracturing operation. The use of CO_2 miscible gelled hydrocarbon fluids may overcome these limitations by achieving a miscible methane drive mechanism, where produced methane is used to displace the hydrocarbon fracturing fluid from the formation. To facilitate this process more volatile hydrocarbon blends can be used in place of fluids such as diesel fuel. The theory and application of this technology is described in R. Taylor et al., *Optimized Gas-Well Stimulation Using CO2-Miscible, Viscosified Hydrocarbon Fracturing Fluids*, SOC'Y OF PETROLEUM ENGINEERS 75666 (2002), the relevant disclosure of which is herein incorporated by reference. In addition, extended clean up may result in costly loss of production. Also, additional equipment such as a service rig for swabbing, or coiled tubing in combination with N_2, to remove liquids from the well bore may be required.

[0018] Other embodiments of the servicing fluids of the present invention may comprise hydrocarbon blends that comprise carbon dioxide and at least about 65% hydrocarbons having from seven carbons (C_7) through ten carbons (C_{10}). In still other embodiments, the hydrocarbon blend may comprise less than about 1% hydrocarbons greater than C_{10}, or less than about 1% hydrocarbons below C_7, or both. In preferred embodiments, the hydrocarbon blends of the present invention exhibit a Reid Vapor Pressure below about 2 psi. Reid Vapor Pressure is a measurement of a fluid's volatility. Industry standards generally call for maintaining the Reid Vapor Pressure of servicing fluids below about 2 psi to help ensure that the servicing fluid is safe for use.

[0019] In some embodiments of the present invention, the hydrocarbon blends of the present invention may be gelled with a gelling agent to provide a gelled servicing fluid. Any gelling agent known by those skilled in the art to be suitable for gelling hydrocarbon-based fluids may be suitable for use in the present invention. For example, suitable gelling agents may include ferric iron or aluminum polyvalent metal complexes of orthophosphoric acid esters and ferric iron or aluminum polyvalent metal complexes of alkylphosphonic acid esters, and ferric iron or aluminum polyvalent metal complexes of unsymmetrical dialkylphosphinic acids. Examples of such iron or aluminum polyvalent metal salts of alkylphosphonic acid esters are provided in Taylor *et al.*, U.S. Pat. No. 6,511,944, issued on Jan. 28, 2003, the relevant disclosure of which is incorporated herein by reference. The gelling agent may be added to the servicing fluids of the present invention in an amount sufficient to provide enhanced viscosity. In an exemplary embodiment, the gelling agent may be present in servicing fluids of the present invention in an amount in the range of from about 0.1% to about 2.5% by weight of the servicing fluids.

[0020] In a further embodiment, the servicing fluids may further comprise a gel breaker. Any gel breaker known by those skilled in the art to be suitable for use with gelled hydrocarbon-based fluids may be suitable for use to in the present invention. Examples of such gel breakers are provided in Taylor *et al.*, U.S. Pat. No. 6,544,934, issued on Apr. 8, 2003, the disclosure of which is incorporated herein by reference.

[0021] In another embodiment the servicing fluids of the present invention may include any of the various servicing fluid additives commonly used in the art. Such additives include, but are not limited to, particulates, delayed breakers, surfactants, fluid loss additives, and weighting materials.

[0022] In other exemplary embodiments, the carbon dioxide miscible hydrocarbon blends of the present invention may be combined with a liquefied petroleum gas ("LPG"). As used herein, the term LPG refers to a hydrocarbon provided in a liquid state that is a gas at standard conditions (about 60°F and about 1 atmosphere (14.7 psi) pressure). For example, such hydrocarbons may include, but are not limited to, methane, ethane, propane, butane and iso-butane. In exemplary embodiments, LPG fluids of the present invention may further comprise other hydrocarbon components that are a liquid at standard conditions, having five carbon atoms or more, which are present in commercial supplies of LPG. The hydrocarbon blends of the

present invention are suitable for use as servicing fluids in both gelled and ungelled forms and may be combined with a gelled or ungelled LPG. In an alternative embodiment, the combination may include any of the various servicing fluid additives commonly used in the art. Such additives include, but are not limited to, particulates, delayed breakers, surfactants, fluid loss additives, and weighting materials.

[0023] In some embodiments, a carbon dioxide miscible hydrocarbon blend servicing fluid of the present invention may be combined with an LPG servicing fluid at the well head to create a combined servicing fluid that may be directly used in a subterranean formation. In such embodiments, traditional equipment can be used to create a servicing fluid according to the present invention that may comprise particulates and/or any of the various servicing fluid additives commonly used in the art. The carbon dioxide miscible hydrocarbon blends and the LPG fluids may be combined in amounts sufficient to provide the desired treatment effect, such as stimulation and/or a desired completion of the subterranean formation, as well as provide maximum fluid recovery from the subterranean formation. In some embodiments of the present invention, it may be desirable to alter the relative percentages of the hydrocarbon blend to the LPG fluid for a particular servicing application. For example, where a servicing fluid comprising the carbon dioxide miscible hydrocarbon blends of the present invention and LPG is used as a fracturing fluid, it may be desirable to begin using a fluid comprising 100% LPG. During the fracturing application, the percentage of the hydrocarbon blend may increase or fluctuate, as needed, to effect the desired subterranean treatment including desired down hole proppant concentrations.

[0024] In certain embodiments, the servicing fluids of the present invention may further comprise particulates, such as gravel or proppant. For example, the servicing fluids of the present application are well suited to be used as fracturing fluids, gravel packing fluids, and fluids used during frac pack operations. Particulates used in accordance with the present invention are generally of a size such that formation particulates that may migrate with produced fluids are prevented from being produced from the subterranean formation. Any suitable particulate may be used including, but not limited to, graded sand, bauxite, ceramic materials, glass materials, nut hulls, polymer beads, and the like. Generally, the particulates have a size in the range of from about 4 to about 400 mesh, U.S. Sieve Series. In an exemplary embodiment, the particulates may be present in the servicing fluids of the present invention in an amount less

than about 14 lbs/gallon of the servicing fluids. In other embodiments, the particulates may be present in the servicing fluids of the present invention in an amount less than about 10 lbs/gallon of the servicing fluids. One of ordinary skill in the art with the benefit of this disclosure will be able to determine the type and amount of particulate suitable for use in the operation at issue.

[0025] One method of the present invention provides an improved method of fracturing a desired zone in a subterranean formation using an improved servicing fluid of the present invention. In some such fracturing methods, a fracturing fluid comprising at least about 65% hydrocarbons having from six carbons (C_6) and through eleven carbons (C_{11}) is placed in the subterranean formation at a rate and pressure sufficient to form or enhance at least one fracture in the subterranean formation, and then the fracturing fluid is substantially removed from the subterranean formation. In some embodiments of the present invention, a fracturing fluid may further comprise proppant. Also, in some embodiments of the present invention, the fracturing fluid comprising at least about 65% hydrocarbons from C_6 through C_{11} may be combined with an LPG fluid before it is placed into the subterranean formation. In methods wherein a servicing fluid comprising at least about 65% hydrocarbons from C_6 through C_{11} is combined with an LPG fluid, the relative percentages of LPG fluid to $C_6 - C_{11}$ fluid may remain constant throughout the fracturing treatment or may be varied. One skilled in the art will recognize that the fracturing methods referred to above may also be used in "frac packing" operations wherein the fracture operation is allowed to screenout and form a gravel pack in conjunction with a proppant filled fracture.

[0026] Another method of the present invention provides an improved method of gravel packing using a servicing fluid of the present invention. In some such gravel packing methods, a gravel packing fluid, comprising at least about 65% hydrocarbons between C_6 and C_{11} and having gravel suspended therein, is placed in a region of a well bore such that at least a portion of the gravel particles form a gravel pack substantially adjacent to the well bore. The gravel packing fluid is then substantially removed from the subterranean formation. In some embodiments of the present invention, a gravel packing fluid comprising at least about 65% hydrocarbons from C_6 through C_{11} may be combined with a LPG fluid before it is placed into the well bore. In methods wherein a servicing fluid comprising at least about 65% hydrocarbons from C_6 through C_{11} is combined with a LPG fluid, the relative percentages of LPG fluid to the $C_6 - C_{11}$ fluid may remain constant throughout the fracturing treatment or may be varied.

[0027] Another method of the present invention provides a method of drilling a well bore penetrating one or more crude oil producing zones using a drill-in fluid of the present invention. In some such gravel packing methods, a drill-in fluid, comprising at least about 65% hydrocarbons between C_6 and C_{11}, is used as to drill a well bore and then substantially removed from the subterranean formation. In some embodiments of the present invention, a drill-in fluid comprising at least about 65% hydrocarbons from C_6 through C_{11} may be combined with a LPG fluid before it is placed into the well bore.

[0028] Therefore, the present invention is well adapted to carry out the objects and attain the ends and advantages mentioned as well as those that are inherent therein. While numerous changes may be made by those skilled in the art, such changes are encompassed within the spirit and scope of this invention as defined by the appended claims.

What is claimed is:

1. A method of treating a subterranean formation comprising the steps of:

providing a servicing fluid comprising carbon dioxide and a hydrocarbon blend, wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}); and

placing the servicing fluid into the subterranean formation.

2. The method of claim 1 wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from seven carbons (C_7) to ten carbons (C_{10}).

3. The method of claim 1 wherein about 85% of the hydrocarbon blend comprises hydrocarbons having eight carbons (C_8), hydrocarbons having nine carbons (C9), or a mixture of hydrocarbons having eight carbons (C_8) and hydrocarbons having nine carbons (C9).

4. The method of claim 1 wherein the hydrocarbon blend has a Reid Vapor pressure below about 2 psi.

5. The method of claim 1 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having more than ten carbons (C_{10}).

6. The method of claim 1 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7).

7. The method of claim 1 wherein the servicing fluid further comprises a gelling agent present in an amount in the range of from about 0.1% to about 2.5% by weight of the hydrocarbon blend.

8. The method of claim 7 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of a alkylphosphonic acid ester.

9. The method of claim 7 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of an orthophosphoric acid ester.

10. The method of claim 7 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of an unsymmetrical dialkylphosphinic acid.

11. The method of claim 1 wherein the servicing fluid further comprises a LPG fluid.

12. The method of claim 1 wherein the servicing fluid further comprises particulates.

13. The method of claim 1 wherein the servicing fluid further comprises a delayed gel breaker.

14. The method of claim 1 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7), about 5% hydrocarbons having seven carbons (C_7); about 44% hydrocarbons having eight carbons (C_8); about 43% hydrocarbons having nine carbons (C_9); about 8% hydrocarbons having ten carbons (C_{10}); and less than about 1% hydrocarbons having more than ten carbons (C_{10}).

15. The method of claim 14 wherein the hydrocarbon blend comprises substantially no hydrocarbons having more than eleven carbons (C_{11}).

16. The method of claim 1 wherein the servicing fluid comprises from about 30 volume % to about 80 volume % carbon dioxide by volume of hydrocarbon blend.

17. A method of fracturing a subterranean formation comprising the step of placing a fracturing fluid comprising carbon dioxide and a hydrocarbon blend into the subterranean formation at a pressure sufficient to create at least one fracture therein wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}).

18. The method of claim 17 wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from seven carbons (C_7) to ten carbons (C_{10}).

19. The method of claim 17 wherein about 85% of the hydrocarbon blend comprises hydrocarbons having eight carbons (C_8), hydrocarbons having nine carbons (C_9), or a mixture of hydrocarbons having eight carbons (C_8) and hydrocarbons having nine carbons (C_9).

20. The method of claim 17 wherein the hydrocarbon blend has a Reid Vapor pressure below about 2 psi.

21. The method of claim 17 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having more than 10 carbons (C_{10}).

22. The method of claim 17 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7).

23. The method of claim 17 wherein the fracturing fluid further comprises a gelling agent present in an amount in the range of from about 0.1% to about 2.5% by weight of the hydrocarbon blend.

24. The method of claim 23 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of a alkylphosphonic acid ester.

25. The method of claim 23 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of an orthophosphoric acid ester.

26. The method of claim 23 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of an unsymmetrical dialkylphosphinic acid.

27. The method of claim 17 wherein the fracturing fluid further comprises a LPG fluid.

28. The method of claim 17 wherein the fracturing fluid further comprises particulates.

29. The method of claim 17 wherein the fracturing fluid further comprises a delayed gel breaker.

30. The method of claim 17 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7), about 5% hydrocarbons having seven carbons (C_7); about 44% hydrocarbons having eight carbons (C_8); about 43% hydrocarbons having nine carbons (C_9); about 8% hydrocarbons having ten carbons (C_{10}); and less than about 1% hydrocarbons having more than ten carbons (C_{10}).

31. The method of claim 30 wherein the hydrocarbon blend comprises substantially no hydrocarbons having more than eleven carbons (C_{11}).

32. The method of claim 17 wherein the servicing fluid comprises from about 30 volume % to about 80 volume % carbon dioxide.

33. A method of placing a gravel pack in a subterranean zone comprising the steps of:

providing a gravel pack composition comprising gravel particles, carbon dioxide, and a hydrocarbon blend wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}); and,

introducing the gravel pack composition into the well bore so that the gravel particles form a gravel pack substantially adjacent to the well bore.

34. The method of claim 33 wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from seven carbons (C_7) to ten carbons (C_{10}).

35. The method of claim 33 wherein about 85% of the hydrocarbon blend comprises hydrocarbons having eight carbons (C_8), hydrocarbons having nine carbons (C_9), or a mixture of hydrocarbons having eight carbons (C_8) and hydrocarbons having nine carbons (C_9).

36. The method of claim 33 wherein the hydrocarbon blend has a Reid Vapor pressure below about 2 psi.

37. The method of claim 33 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having more than ten carbons (C_{10}).

38. The method of claim 33 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7).

39. The method of claim 33 wherein the gravel composition further comprises a gelling agent present in an amount in the range of from about 0.1% to about 2.5% by weight of the hydrocarbon blend.

40. The method of claim 39 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of a alkylphosphonic acid ester.

41. The method of claim 39 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of an orthophosphoric acid ester.

42. The method of claim 39 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of an unsymmetrical dialkylphosphinic acid.

43. The method of claim 33 wherein the gravel composition further comprises a LPG fluid.

44. The method of claim 33 wherein the gravel composition further comprises particulates.

45. The method of claim 33 wherein the gravel composition further comprises a delayed gel breaker.

46. The method of claim 33 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7), about 5% hydrocarbons having seven carbons (C_7); about 44% hydrocarbons having eight carbons (C_8); about 43% hydrocarbons having nine carbons (C_9); about 8% hydrocarbons having ten carbons (C_{10}); and less than about 1% hydrocarbons having more than ten carbons (C_{10}).

47. The method of claim 46 wherein the hydrocarbon blend comprises substantially no hydrocarbons having more than eleven carbons (C_{11}).

48. The method of claim 33 wherein the servicing fluid comprises from about 30 volume % to about 80 volume % carbon dioxide.

49. A method of drilling in a subterranean zone comprising the steps of:

providing a drill-in fluid comprising carbon dioxide and a hydrocarbon blend wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}); and,

drilling into a formation using the drill-in fluid so as to create a well bore penetrating a producing formation.

50. The method of claim 49 wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from seven carbons (C_7) to ten carbons (C_{10}).

51. The method of claim 49 wherein about 85% of the hydrocarbon blend comprises hydrocarbons having eight carbons (C_8), hydrocarbons having nine carbons (C_9), or a mixture of hydrocarbons having eight carbons (C_8) and hydrocarbons having nine carbons (C_9).

52. The method of claim 49 wherein the hydrocarbon blend has a Reid Vapor pressure below about 2 psi.

53. The method of claim 49 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having more than ten carbons (C_{10}).

54. The method of claim 49 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7).

55. The method of claim 49 wherein the drill-in fluid further comprises a gelling agent present in an amount in the range of from about 0.1% to about 2.5% by weight of the hydrocarbon blend.

56. The method of claim 55 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of a alkylphosphonic acid ester.

57. The method of claim 55 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of an orthophosphoric acid ester.

58. The method of claim 55 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of an unsymmetrical dialkylphosphinic acid.

59. The method of claim 49 wherein the drill-in fluid further comprises a LPG fluid.

60. The method of claim 49 wherein the drill-in fluid further comprises a delayed gel breaker.

61. The method of claim 49 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7), about 5% hydrocarbons having seven

carbons (C_7); about 44% hydrocarbons having eight carbons (C_8); about 43% hydrocarbons having nine carbons (C_9); about 8% hydrocarbons having ten carbons (C_{10}); and less than about 1% hydrocarbons having more than ten carbons (C_{10}).

62. The method of claim 61 wherein the hydrocarbon blend comprises substantially no hydrocarbons having more than eleven carbons (C_{11}).

63. The method of claim 49 wherein the servicing fluid comprises from about 30 volume % to about 80 volume % carbon dioxide.

64. A subterranean servicing fluid comprising carbon dioxide and a hydrocarbon blend wherein the hydrocarbon blend comprises and at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}).

65. The servicing fluid of claim 64 wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from seven carbons (C_7) to ten carbons (C_{10}).

66. The method of claim 64 wherein about 85% of the hydrocarbon blend comprises hydrocarbons having eight carbons (C_8), hydrocarbons having nine carbons (C_9), or a mixture of hydrocarbons having eight carbons (C_8) and hydrocarbons having nine carbons (C_9).

67. The servicing fluid of claim 64 wherein the hydrocarbon blend has a Reid Vapor pressure below about 2 psi.

68. The servicing fluid of claim 64 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having more than ten carbons (C_{10}).

69. The servicing fluid of claim 64 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7).

70. The method of claim 64 wherein the servicing fluid further comprises a gelling agent present in an amount in the range of from about 0.1% to about 2.5% by weight of the hydrocarbon blend.

71. The method of claim 70 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of a alkylphosphonic acid ester.

72. The method of claim 70 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of an orthophosphoric acid ester.

73. The method of claim 70 wherein the gelling agent comprises a ferric iron or aluminum polyvalent metal complex of an unsymmetrical dialkylphosphinic acid.

74. The servicing fluid of claim 64 wherein the servicing fluid further comprises a LPG fluid.

75. The servicing fluid of claim 64 wherein the servicing fluid further comprises particulates.

76. The servicing fluid of claim 64 wherein the servicing fluid further comprises a delayed gel breaker.

77. The servicing fluid of claim 64 wherein the hydrocarbon blend comprises less than about 1% hydrocarbons having fewer than seven carbons (C_7), about 5% hydrocarbons

having seven carbons (C_7); about 44% hydrocarbons having eight carbons (C_8); about 43% hydrocarbons having nine carbons (C_9); about 8% hydrocarbons having ten carbons (C_{10}); and less than about 1% hydrocarbons having more than ten carbons (C_{10}).

78. The servicing fluid of claim 77 wherein the hydrocarbon blend comprises substantially no hydrocarbons having more than eleven carbons (C_{11}).

79. The method of claim 64 wherein the servicing fluid comprises from about 30 volume % to about 80 volume % carbon dioxide.

CO_2 MISCIBLE OPTIMIZED HYDROCARBON BLENDS AND METHODS OF USING CO_2 MISCIBLE OPTIMIZED HYDROCARBON BLENDS

ABSTRACT

[0029] A method of treating a subterranean formation comprising the steps of providing a servicing fluid comprising carbon dioxide and a hydrocarbon blend, wherein the hydrocarbon blend comprises at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}); and placing the servicing fluid into the subterranean formation. A subterranean servicing fluid comprising carbon dioxide and a hydrocarbon blend wherein the hydrocarbon blend comprises and at least about 65% hydrocarbons having from six carbons (C_6) to eleven carbons (C_{11}).

APPENDIX E: U.S. PATENT NO. 4,825,952 ("*MZIK*")

United States Patent [19]

Mzik

[11] Patent Number: 4,825,952

[45] Date of Patent: May 2, 1989

[54] **FRACTURING PROCESS FOR LOW PERMEABILITY RESERVOIRS EMPLOYING A COMPATIBLE HYDROCARBON-LIQUID CARBON DIOXIDE MIXTURE**

[75] Inventor: **Joseph Mzik, Calgary, Canada**

[73] Assignee: **Dwight N. Loree, Calgary, Alberta, Canada**

[21] Appl. No.: **234,594**

[22] Filed: **Aug. 22, 1988**

[30] **Foreign Application Priority Data**

Nov. 13, 1987 [CA] Canada 551,804

[51] Int. Cl.[4] E21B 43/26; E21B 43/267

[52] U.S. Cl. 166/308; 252/8.551

[58] Field of Search 166/308, 307, 271, 281, 166/282, 259; 252/8.551

[56] **References Cited**

U.S. PATENT DOCUMENTS

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3,396,107	8/1968	Hill	166/308 X
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3,846,310	11/1974	Blackwell et al.	252/8.551 X
4,374,545	2/1983	Bullen et al.	166/280
4,519,455	5/1985	Holtmyer et al.	166/308 X
4,701,270	10/1987	Bullen et al.	166/308 X

Primary Examiner—Stephen J. Novosad

[57] **ABSTRACT**

A method is described for fracturing a subterranean formation penetrated by a wellbore. A fracturing fluid in the form of a mixture of liquid carbon dioxide and a liquid hydrocarbon component of specific characteristics is injected down the wellbore under pressure to cause fracturing. The hydrocarbon component contains at least 70 wt. % of C_5-C_{14} constituents and at least 8 wt. % aromatics and has an average molecular mass of less than 200, a pour point of less than −40° C. and a density of from 0.77 to 0.85 g/ml at 15° C. This hydrocarbon component provides a higher viscosity than the liquid carbon dioxide at lower temperatures and is also an excellent solvent, simplifying clean-up. The novel fracturing fluid may also contain the usual proppants.

6 Claims, No Drawings

FRACTURING PROCESS FOR LOW PERMEABILITY RESERVOIRS EMPLOYING A COMPATIBLE HYDROCARBON-LIQUID CARBON DIOXIDE MIXTURE

BACKGROUND OF THE INVENTION

This invention relates to compositions for use in fracturing underground formations such as gas wells, particularly the fracturing of low permeability formations using such compositions.

The fracturing process involves the injecting of a treating fluid down to the wellbore and into the productive formation at a sufficient rate and pressure so that the formation rock fractures from the induced stresses. A proppant added into the fluid prevents closure of the fracture when hydraulic pressures are released, thereby leaving a conductive flow channel from the wellbore deep into the rock matrix.

For several years liquid carbon dioxide has been added to fracturing fluids to assist in post-treatment clean up. It was applied with oil or water based treating fluids at various ratios. Higher concentrations of liquid carbon dioxide in the fracturing fluid have been proven beneficial, leading to a reduction in the volume of treating fluids. The latest development in the fracturing process uses highly energized liquid carbon dioxide as the sole proppant carrier. The application of pure liquid carbon dioxide eliminates most of the formation damage normally associated with convention fracturing fluids and enables a very rapid clean up and evaluation of the well following the stimulation. However, when pure liquid carbon dioxide is applied and a sufficient fracture width not produced, a significant decline in productivity can be observed within several months after the stimulation.

Density and viscosity are the most important characteristics of the fracturing fluid. Both density and viscosity affect the carrying capacity of the fluid for sand, while viscosity is primarily responsible for the final fracture shape and profile. A wide range of additives are used to enhance the rheological and chemical properties of the oil, water or alcohol base treating fluids. Liquid carbon dioxide has a very low viscosity and its physical, chemical and thermodynamic properties over a wide range of temperatures occurring during the fracturing processes limit the choice of additives considerably.

Several concepts were considered for the thickening of liquid carbon dioxide. For fracturing purposes an ideal situation would have the viscosity of thickened carbon dioxide decrease at bottom hole conditions without leaving solid or liquid residue in the formation. One way to achieve this was to have a novel composition using the concept of copolymerization of liquid carbon dioxide and propylene oxide as disclosed in U.S. Pat. No. 4,374,545. However, this system requires precise preparation, timing and handling of chemicals.

It is the object of the present invention to overcome the disadvantages of the prior art and provide a simpler and more effective fracturing process utilizing the conventional fracturing equipment now in use.

SUMMARY OF THE INVENTION

It has been observed that the viscosity of petroleum is increased more rapidly with decreasing temperature than any other suitable polymeric solution. Thus, petroleum could be useful in the fracturing process if a hydrocarbon mixture could be found having required properties and which could be miscible with liquid carbon dioxide.

According to the present invention, it has been found that a hydrocarbon-liquid carbon dioxide mixture, without addition of thickening agents, is capable of providing a higher viscosity than liquid carbon dioxide and ensuring a greater fracture width. It is also capable of acting as a better solvent than liquid carbon dioxide and simplifies clean up. The hydrocarbon component of the mixture has the following characteristics:

(a) an average molecular mass of less than 200;
(b) a content of at least 70 wt. % of C_5-C_{14} constituents;
(c) a content of at least 8 wt. % of aromatics;
(d) a pour point of less than −40° C.
(e) a density of from 0.77 to 0.85 g/mL at 15° C.

Preferably the hydrocarbon component has an average molecular mass of less than 150 and a density of 0.78 to 0.8 g/ml at 15° C. The aliphatic hydrocarbon mixture having the above properties is miscible with liquid CO_2 without presence of aromatics.

The hydrocarbon mixture comprises of aliphatic hydrocarbon components obtained by blending of petroleum products of light and intermediate distillates, such as light and heavy naphtha, kerosine, light gas oil, etc., with the aromatics such as ethylbenzene, methyl-, dimethyl-, and trimethylbenzene; or a mixture of the above. Although 1, 2-dimethylbenzene is the most suitable aromatic compound, the multicomponent mixtures of aromatics are preferred. Various gas condensates are a good source of aromatics and their increased content within the hydrocarbon component is often desirable.

The liquid carbon dioxide and hydrocarbon component can be combined in widely varying proportions, but will usually be in the proportions of about 95 to 15 vol. % liquid carbon dioxide to 5 to 85 vol. % hydrocarbon component. They are preferably in the proportions of about 60 to 40 vol. % liquid carbon dioxide to about 40 to 60 vol. % hydrocarbon component. The liquid carbon dioxide and hydrocarbon components are preferably combined on the surface and injected as a mixture down the wellbore, but they may be combined within the formation. The fracturing fluid of this invention is very simple and safe to use in the field and can be injected using conventional fracturing equipment. For instance, it may be mixed with any of the usual propping agents, such as sands.

In any given application of the process in practice, the rate of injection and the initial temperature of the liquid carbon dioxide must be determined in each instance by the depth and temperature of the well. All of the necessary information is available to the petroleum engineer from well completion data and from standard engineering books and tables.

This invention is best understood by reference to the following example, which is offered only as an illustrative embodiment of my invention, and is not intended to be limitative or restrictive thereof.

EXAMPLE

A gas well located at Trilogy et al Saxon 16-10-61-25 W5, Alberta having been completed with a 5½ inch casing to a depth of about 8,860 feet was treated by the process of the instant invention. For the treatment there was used liquid CO_2, 40/60 mesh silica sand proppant and a hydrocarbon distillate having the following characteristics:

(a) The average molecular mass of the hydrocarbon composition was lower than 120.

(b) The hydrocarbon contained over 80 percent of C_5–C_{14} constituents.

(c) The hydrocarbon mixture contained over 30 percent of aromatics.

(d) The pour point of the hydrocarbon mixture was lower than −50° C.

(e) The hydrocarbon density was 0.800 g/ml at 15° C.

The liquid CO_2 was admixed with the hydrocarbon component in a proportion of about 50 vol. % liquid CO_2 and about 50 vol. % hydrocarbon component. The resulting mixture was blended with proppant sand at a concentration of 1–12 pounds per gallon of liquid CO_2-hydrocarbon mixture and the resulting slurry was injected down the well and forced back into the formation at a pressure of about 6,000 psi which fractured the formation. By this technique, 42,500 pounds of 20/40 mesh sand was successfully placed in the zone.

Two hours after completion of the frac, the well started flowing back and 36 hours later, 100% of liquid (load fluid) was recovered. The well tested at 300 MCF.

I claim:

1. The method of treating a subterranean formation penetrated by a wellbore which comprises injecting into the formation a fluid mixture comprising (1) liquid carbon dioxide and (2) a liquid hydrocarbon component containing at least 70 wt. % of C_5–C_{14} constituents and at least 8 wt. % aromatics and has an average molecular mass of less than 200, a pour point of less than −40° C. and a density of from 0.77 to 0.85 g/ml at 15° C., said fluid mixture being injected at a pressure sufficient to cause fracturing, and thereafter releasing the pressure on the injected fluid mixture whereby the fracturing fluid becomes readily flowable and flows back out of the formation and up the wellbore.

2. The method according to claim 1 wherein the liquid carbon dioxide and liquid hydrocarbon component are mixed on surface and the fluid mixture is injected down the wellbore.

3. The method according to claim 1 wherein the liquid carbon dioxide and liquid hydrocarbon component are mixed within the formation.

4. The method according to claim 1 wherein the fluid mixture contains about 95–15 vol. % liquid carbon dioxide and about 5–85 vol. % hydrocarbon component.

5. The method according to claim 1 wherein the fluid mixture contains about 60–40 vol. % liquid carbon dioxide and about 40–60 vol. % hydrocarbon component.

6. The method according to claim 4 wherein the fluid mixture also contains proppants.

* * * * *

APPENDIX F: CITED OPINIONS OF THE BOARD OF PATENT APPEALS AND INTERFERENCES

Contents:

1. *Ex parte* Lanzendorfer *et al.*, Appeal No. 2006-1383, 2006 WL 2558175, at *2 (Bd. Pat. App. & Interf.).

2. *Ex parte* Che *et al.*, Appeal No. 2005-0178, 2005 WL 4773740, at *4 (Bd. Pat. App. & Interf. Feb. 9, 2005).

3. *Ex parte* Ferber *et* al., Appeal No. 2004-1622, 2004 WL 4983375, at *3 (Bd. Pat. App. & Interf. Dec. 9, 2004).

4. *Ex parte* Dornfeld et *al.*, Appeal No. 2002-1029, 2004 WL 4972873, at *2 (Bd. Pat. App. & Interf. Sept. 30, 2004).

5. *Ex parte* Cornell *et al.*, Appeal No. 2001-0059, 2006 WL 2523874, at *2 (Bd. Pat. App. & Interf. Dec. 23, 2002).

6. *Ex parte* Sicking *et al.*, Appeal No. 2000-0523, 2001 WL 1057283, at *4 (Bd. Pat. App. & Interf.).

7. *Ex parte* Nikkel *et al.*, Appeal No. 1999-1718, 2001 WL 1149824, at *3 (Bd. Pat. App. & Interf.).

8. *Ex parte* Peng, Appeal No. 1999-0037, 2001 WL 1339925, at *4 (Bd. Pat. App. & Interf.).

2006 WL 2558175 (Bd.Pat.App & Interf.)
(Cite as: 2006 WL 2558175 (Bd.Pat.App & Interf.))

*1 THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

Board of Patent Appeals and Interferences

Patent and Trademark Office (P.T.O.)
EX PARTE GHITA LANZENDORFER, ANGELIKA BORMANN, JENS NIELSEN, BIRGIT HARGENS, HEIDI RIEDEL, AND STEPHANIE VON THADEN
Appeal No. 2006-1383
Application No. 10/025,065

NO DATE REFERENCE AVAILABLE FOR THIS DOCUMENT

Before ADAMS, GRIMES, and GREEN

Administrative Patent Judges

ADAMS

Administrative Patent Judge

ON BRIEF [FN1]

DECISION ON APPEAL

This is a decision on the appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 1, and 3-8, which are all the claims pending in the application.

Claims 1 and 4 are illustrative of the subject matter on appeal and are reproduced below:

1. A cosmetic or dermatological emulsion of the oil-in-water type, comprising

(i) up to 90% by weight of a water phase,

(ii) 0.5% to 20% by weight of a lipid phase, based on the total weight of the preparation,

(iii) up to 10% by weight of one or more emulsifiers, and

(iv) 0.2% to 0.3% by weight of one or more ammonium acryloyldimethyltaurates/vinylpyrrolidone copolymers.

4. The emulsion as claimed in claim 1, further comprising one or more dyes, coloring pigments, or a combination thereof.

The examiner relies on the following reference:

Löffler 6,489,395 Dec. 3, 2002

GROUNDS OF REJECTION

Claims 1, 3 and 6 stand rejected under 35 U.S.C. § 103 as being unpatentable over Löffler.

Claims 4, 5, 7 and 8 stand rejected under 35 U.S.C. § 103 as being unpatentable over Löffler in view of appellants' "admitted prior art".

We reverse the rejection of record. In addition, we encourage the examiner to consider the Other Issue section of this opinion and to take appropriate action.

DISCUSSION

Claims 1, 3 and 6

Claims 1, 3 and 6 stand rejected under 35 U.S.C. § 103 as being unpatentable over Löffler.

With reference to examples 1-7 of Löffler, the examiner finds (Answer, page 3) that Löffler teaches an oil-in-water composition comprising "69.10 - 81.90% water [FN2], 5 - 20% lipid phase such as Jojoba oil and mineral oil, 0.1 - 5% oligoester emulsifiers which may be up to 10%, and [0.6 - 0.7%] Aristoflex AVC...." According to the examiner (id.), the only difference between Löffler and appellants' claimed invention, is that Löffler does not teach the use of "0.2 to 0.3% of Aristoflex AVC." Appellants do not dispute these findings. See Brief, page 4.

*2 Appellants, however, part company with the examiner when the examiner asserts (Answer, page 3), "[i]t would have been obvious to a person of ordinary skill in the art at the time the invention was made to optimize and determine the particular amount of Aristoflex AVC in the composition, e.g. 0.2 to 0.3% of Aristoflex AVC." In contrast, appellants assert (Brief, page 4) that Löffler

> merely lists Aristoflex AVC as an ingredient in some examples, but nowhere discloses what it is, what it does, or why it is present. The description is totally silent about ... (Aristoflex AVC). In the face of this void, there is absolutely no teaching or suggestion to reduce the amount to 0.2-0.3%. For there to be such a suggestion, there would have to at least be some disclosure of the reasons why Aristoflex was included in the first place, or of what it does. No one would be motivated to "select optimum parameters ... to achieve a beneficial effect", as the Examiner contends, if they do not know what beneficial effect there is to be achieved, or what parameter is to be modified.

There is some merit to both sides of this argument, for the examiner is correct in that the "discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art," In re Boesch, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980) (citations omitted). Appellants, however, are equally correct in that our reviewing court has found an exception to this general rule where "the parameter optimized was not recognized to be a result effective variable," In re Antonie, 559 F.2d 618, 621, 195 USPQ 6, 8 (CCPA 1977).

Therefore, to resolve this issue, we must look to the function of Aristoflex AVC serves in Löffler's composition, and whether a person of ordinary skill in the art

would have recognized that Aristoflex AVC is a result effective variable from the teachings of Löffler.

I. What purpose does Aristoflex AVC serve in Löffler's composition?

The examiner does not identify, and we find no disclosure in Löffler regarding the function of Aristoflex AVC in Löffler's disclosed compositions. In this regard, we note that Löffler's only specific disclosure of Aristoflex AVC is in examples 1-7. Therefore, we find ourselves in agreement with appellants (Brief, page 4), "[n]o person reading Löffler would have any idea of what the Aristoflex AVC does in his compositions...."

II. Is Aristoflex AVC a results effective variable?

From the foregoing discussion it should be clear that there is no evidence on this record that the prior art relied upon by the examiner recognized that Aristoflex AVC has any particular effect on the compositions taught by Löffler, which according to Löffler (column 1, lines 23-24) are "emulsions comprising an oligoester." As appellants point out (Brief, page 4), "[n]o person reading Löffler would have any idea of what the Aristoflex AVC does in his compositions, and would certainly have no reason to vary his amounts." We agree. Simply put, the examiner failed to meet her burden of presenting the evidence necessary to establish a prima facie case of obviousness.

Conclusion:

*3 For the foregoing reasons we reverse the rejection of claims 1, 3 and 6 under 35 U.S.C. § 103 as being unpatentable over Löffler.

Claims 4, 5, 7 and 8

Claims 4, 5, 7 and 8 stand rejected under 35 U.S.C. § 103 as being unpatentable over Löffler in view of appellants' "admitted prior art".

Despite Löffler's disclosure that dyes may be added to the compositions disclosed therein (see column 4, lines 19-25, and column 5, lines 8-9), the examiner finds that Löffler "does not expressly disclose the compositions therein further comprising one or more dyes coloring pigments." Answer, page 4. Therefore, the examiner relies on appellants' specification to make up for this alleged deficiency in Löffler. Answer, bridging paragraph, pages 4-5.

This secondary evidence, however, fails to make up for Löffler's failure to teach a composition comprising 0.2% to 0.3% by weight of one or more ammonium acryloyldimethyltaurates/vinylpyrrolidone copolymers as is required by appellants' claimed invention. Accordingly, we reverse the rejection of claims 4, 5, 7 and 8 under 35 U.S.C. § 103 as being unpatentable over Löffler in view of appellants' "admitted prior art".

OTHER ISSUES

As discussed above, the evidence of record on appeal was deficient because it

failed to establish why a person of ordinary skill in the art would add Aristoflex AVC to a composition. Without this knowledge, one would have no reason to "optimize" its amount in the composition taught by Löffler. Accordingly, upon receipt of the administrative file we encourage the examiner to take a step back and reconsider the invention together with the available prior art to determine why a person of ordinary skill in the art at the time of appellants' invention would include Aristoflex AVC in a composition such as that described by Löffler. For illustrative purposes, we direct the examiner's attention to Weihofen [FN3], which teaches the use of Aristoflex AVC as a thickener.

If after having an opportunity to review the administrative file together with the available prior art, the examiner is of the opinion that a rejection is necessary, the examiner should issue the appropriate rejection, clearly and articulately explaining the basis of the rejection and the evidence relied upon to support the position taken.

SUMMARY

The rejections of record are reversed.

Prior to taking any further action on the merits we encourage the examiner to consider the observations made in the "OTHER ISSUES" section and take appropriate action.

REVERSED

BOARD OF PATENT APPEALS AND INTERFERENCES

Donald E. Adams

Administrative Patent Judge

Eric Grimes

Administrative Patent Judge

Lora M. Green

Administrative Patent Judge

CLARIANT CORPORATION

*4 INTELLECTUAL PROPERTY DEPARTMENT

4000 MONROE ROAD

CHARLOTTE NC 28205

FN1. Appellants waived their request for oral hearing. Paper received June 23, 2006. Accordingly, we considered this appeal on Brief.

FN2. For clarity, we note that the emulsions taught by Löffler "may comprise 5 to 95% by weight ... water." Löffler, column 3, lines 61-63.

FN3. Weihofen et al. (Weihofen), "Hydrafresh with the right polymer," Clariant, pages 32-33 (February 2001)

END OF DOCUMENT

2005 WL 4773740 (Bd.Pat.App & Interf.)
(Cite as: 2005 WL 4773740 (Bd.Pat.App & Interf.))

*1 THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

Board of Patent Appeals and Interferences

Patent and Trademark Office (P.T.O.)
EX PARTE YONG CHE, TAKESHI MORINOTO AND MANABU TSUSHIMA
Appeal No. 2005-0178
Application 10/091,502
Heard: February 9, 2005

OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.

1940 Duke Street

Alexandria, VA 22314

Before WALTZ, JEFFREY T. SMITH, and PAWLIKOWSKI

Administrative Patent Judges

PAWLIKOWSKI

Administrative Patent Judge

DECISION ON APPEAL

This is a decision on appeal, under 35 U.S.C. § 134, from the examiner's final rejection of claims 1-16.

Claims 1 and 11 are representative of the subject matter on appeal, and are set forth below:

1. A secondary power source, which comprises:

a positive electrode consisting essentially of activated carbon, from 0.1 to 20% by weight of a conductive material, and 1to 20% by weight of a binder based on the total mass of the positive electrode,

a negative electrode consisting essentially of a carbon material capable of doping and undoping lithium ions and 4 to 30% by weight of a binder based on the total mass of the negative electrode, and

an organic electrolyte containing a lithium salt,

wherein the negative electrode has a density of from 0.6 to 1.2 g/cm3.

11. A secondary power source, which comprises a positive electrode containing activated carbon, a negative electro decontaining a carbon material capable of doping and undoping lithium ions, and an organic electrolyte containing a lithium salt,

wherein the negative electrode has a density of from 0.7 to 1.0 g/cm3.

The examiner relies upon the following references as evidence of unpatentability:

Kuruma (Japanese Patent) [FN1]	JP 2000-090972	Mar. 31, 2000
Nishimura	6,103,373	Aug. 15, 2000
Tsushima et al. (Tsushima '292)	6,294,292	Sept. 25, 2001
Honbo et al. (Honbo)	6,399,251	June 4, 2002
Tsushima (Tsushima '846)	6,558,846	May 6, 2003

The examiner has entered the following rejections:

I. Claims 1, 2, 5-8, 11, 12, 15 and 16 stand rejected under 35 U.S.C. § 103 as being obvious over Kuruma in view of Honbo.

II. Claims 3, 4, 9, 10, 13, and 14 stand rejected under 35 U.S.C. § 103 as being obvious over Kuruma in view of Honbo, and further in view of Nishimura.

III. Claims 11 and 12 stand rejected under the judicially created doctrine of obviousness-type patenting as being unpatentable over claims 1, 3, 7 and 15 of U.S. Patent 6,294,292 in view of Honbo.

*2 IV. Claims 11 and 12 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 3, 5, 7, and 8 of U.S. Patent No. 6,558,846 in view of Honbo.

We have carefully considered appellants' brief and reply brief [FN2], and the examiner's answer. This review has led us to conclude that the examiner's rejections are not well-founded.

OPINION

I. The 35 U.S.C. § 103 rejection over Kuruma in view of Honbo, and each of the judicially created doctrine of obviousness-type patenting rejections [FN3]

On page 5 of the answer, the examiner recognizes that Kuruma [FN4] does not disclose the specific negative electrode density as claimed in appellants' claim 1. The examiner relies upon Honbo for teaching a negative electrode density that falls within the range claimed by appellants.

Appellants' position with regard to this rejection is set forth on pages 3-12 of the brief (appellants reiterate certain points made, in the reply brief). On page 6 of the brief, appellants argue that Honbo is directed to a complex oxide containing Li and Mn, which has a spinel type crystalline structure, and refer to column 2, lines 38-40 of Honbo. Appellants argue that Honbo discloses that the density range of 0.95 to 1.5 g/cm3 of the negative electrode material prevents the precipitation of Mn on and inside the negative electrode, and refer to column 4, lines 5-17.

Appellants also state that Honbo discloses that the density range of the negative electrode material should be selected to minimize a failure mode which is specific to the Li/Mn oxide composition of the positive electrode material of Honbo. Brief, page 6.

Appellants argue that their claimed secondary power source has a completely different kind of positive electrode material (i.e., activated carbon) which cannot fail in the manner described in Honbo. Appellants conclude that the specific failure mode described in Honbo is not possible in their claimed secondary power source or, for that matter, in the secondary power sources described in Kuruma or in the claims of each of the Tsushima patents. Brief, page 7.

Appellants argue that one of ordinary skill in the art of preparing secondary power sources would not have reasonably considered the disclosure of Honbo to apply to the secondary power source described in Kuruma or in the claims of the Tsushima patents, in which the positive material comprises activated carbon. Brief, page 7.

Accordingly, appellants state that Honbo does not reasonably suggest combining an activated carbon positive electrode with a carbon material negative electrode having a density in the claimed range. Brief, page 7.

On page 15 of the answer, the examiner rebuts and states that Honbo teaches a negative electrode active material, characterized in containing carbon, and having a density in the range larger than .9 g/cm and smaller than 1.5 g/cm, and the examiner concludes that Honbo's teaching clearly encompasses the use of a negative electrode material made of carbon, and having the claimed density range, regardless of the battery chemistry per se.

*3 We agree with appellants' position for the following reasons.

The examiner's position fails to appreciate that before an examiner may combine the disclosures of two or more prior art references in order to establish prima facie obviousness, there must be some suggestion for doing so, found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598-99 (Fed. Cir. 1988). In the instant case, as pointed out by appellants, because of the differences between the secondary power source in Honbo and that of Kuruma or the Tsushima patents, there is no motivation to modify the density of the negative electrode material of Kuruma or the Tsushima patents such that the density is as taught in Honbo.

Of course, it is clear that Honbo teaches a negative electrode containing emulsive carbon as having a negative electrode density in the range as set forth in column 3, lines 57-61. However, the test for obviousness is what the combined teachings of the prior art references would have suggested to those of ordinary skill in the art. In re Young, 927 F.2d 588, 591, 18 USPQ2d 1089, 1091 (Fed. Cir. 1991); In re Keller, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981). The examiner's position fails to explain a suggestion, by the references themselves, or in the knowledge generally available to one of ordinary skill in the art, for modifying the density of the negative electrode material of Kuruma or of the claims of the Tsushima patents, so as to have the density value as taught by Honbo.

While we observe, on page 16 of the answer, that the examiner states that there is suggestion to combine the references because the applied references are found within the same field of endeavor and pertinent to each other because of the battery envir-

onment disclosed in the references, this is not the standard of a prima facie case of obviousness. In re Fine, supra.

Also, on page 17 of the answer, the examiner shifts the burden to appellants to show why Honbo's negative electrode density cannot function in a substantially similar battery environment. This is an incorrect position taken by the examiner. As pointed out by appellants in their reply brief, on page 2, the burden is on the examiner to present a prima facie case of obviousness. For the reasons discussed above, the examiner has failed to do so.

We also note that on page 10 of the brief, appellants discuss the examiner's position regarding the negative electrode density being a result effective variable. Appellants refer to In re Antonie, 559 F.2d 618, 621, 195 USPQ 6, 9 (CCPA 1977). This case stands for the proposition that there are exceptions to the general rule that optimization of a result effective variable is obvious. One exception is that the variable was not recognized to be result effective.

*4 At the top of page 11 of the brief, appellants argue that the applied art discloses no range for a negative electrode density when used with a secondary power source of the type claimed by appellants, and of the type disclosed in Kuruma and of the type recited in the claims of the Tsushima patents.

On page 17 of the answer, the examiner actually agrees with appellants that the applied art fails to recognize that the negative electrode density is a result effective variable. Answer, page 18. The examiner, however, then concludes that the negative electrode density does not impart criticality to the secondary power source, and hence is not supportive of a patentable subject matter. In so doing, the examiner overlooks the above-mentioned case law.

Because it is not disputed by the examiner that the applied art fails to recognize that the negative electrode density is a result effective variable, it follows, according to In re Antonie, that appellants' claimed subject matter is unobvious. Id.

In view of the above, we determine the examiner has not set forth a prima facie case of obviousness. As such, we need not discuss any evidence in connection with unexpected results.

We therefore reverse the rejection under 35 U.S.C. § 103 as being obvious over Kuruma in view of Honbo.

We also reverse each of the rejections under the judicially created doctrine of obviousness-type double patenting for the same reasons that we reverse the rejection under 35 U.S.C. § 103 as being obvious over Kuruma in view of Honbo. As indicated, supra, each of the primary references applied in the rejections under the judicially created doctrine of obviousness-type double patenting did not teach appellants' claimed negative electrode density, and Honbo is not properly combinable with each of these primary references for the same reasons that Honbo is not properly combinable with Kuruma.

II. The Other Rejection

The other rejection before us in this appeal (the rejection of claims 3, 4, 9, 10, 13, and 14 under 35 U.S.C. § 103 as being obvious over Kuruma in view of Honbo, and further in view of Nishimura), is also reversed because Nishimura does not cure the aforementioned deficiencies of Kuruma in view of Honbo.

Hence, for the same reasons, discussed supra, we reverse the rejection of claims 3, 4, 9, 10, 13, and 14 under 35 U.S.C. § 103 as being obvious over Kuruma in view of Honbo, and further in view of Nishimura.

III. Conclusion

Each of the rejections is reversed.

REVERSED

BOARD OF PATENT APPEALS AND INTERFERENCES

Thomas A. Waltz

Administrative Patent Judge

Jeffrey T. Smith

Administrative Patent Judge

*5 Beverly A. Pawlikowski

Administrative Patent Judge

FN1. We rely upon, and cite from, a computer translation of this document into English, previously made of record.

FN2. We have reviewed all of the reply briefs of record. Any referral to the reply brief in this decision is a reference to the reply brief filed on July 26, 2004.

FN3. These 3 rejections involve the same issue (whether Honbo is properly combinable with each of the primary references in each respective rejection).

FN4. The examiner also recognizes that each of the Tsushima patents does not disclose the claimed negative electrode density. Answer, pages 10 and 12.

END OF DOCUMENT

2004 WL 4983375 (Bd.Pat.App & Interf.)
(Cite as: 2004 WL 4983375 (Bd.Pat.App & Interf.))

*1 THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

Board of Patent Appeals and Interferences

Patent and Trademark Office (P.T.O.)
EX PARTE JORGEN FERBER AND BERNHARD WEIGAND
Appeal No. 2004-1622
Application No. 09/431,178
Heard: December 9, 2004

BURNS, DOANE, SWECKER & MATHIS LLP

POST OFFICE BOX 1404

ALEXANDRIA, VA 22313-1404

Before FRANKFORT, STAAB and MCQUADE

Administrative Patent Judges

MCQUADE

Administrative Patent Judge

DECISION ON APPEAL

Jorgen Ferber et al. appeal from the final rejection (Paper No. 20) of claim 1, the sole claim pending in the application.

THE INVENTION

The invention relates to a component, e.g., a turbine blade, having coolant passages for counteracting high thermal loading. Claim 1 reads as follows:

1. A component which can be subjected to high thermal loading and to which a hot-gas flow can be admitted during operation, the component comprising:

at least one hot-gas side for exposure to the hot-gas flow and a cold-gas side not for exposure to the hot-gas flow;

component cooling passages connecting the hot-gas side and the cold-gas side so that when a cooling medium flows from the cold-gas side to the hot-gas side, the cooling medium, when passing through a component passage, absorbs heat from the component and draws off the heat to the hot-gas side;

wherein at least one of the component cooling passages has a length, a hot-side orifice, a cold-side orifice, and a circular cross section over the entire length of the at least one component cooling passage, which cross section increases continu-

ously from the cold-gas side to the hot-gas side, the at least one component cooling passage enclosing an opening half angle so that the at least one component cooling passage is frustoconical;

wherein the opening half angle of the at least one component cooling passage is essentially constant over the length of the passage;

wherein the opening half angle is between 0.2° and 2.5°; and

wherein a ratio of the cross-sectional area of the hot-side orifice of the at least one component cooling passage to the cross-sectional area of the cold-side orifice of the at least one component cooling passage is less than 1.2.

THE EVIDENCE

The item relied on by the examiner as evidence of obviousness is:

Howald 3,527,543 Sep. 08, 1970

The item relied on by the appellants as evidence of non-obviousness is:

The 37 CFR § 1.132 Declaration of Rolf Dittmann filed January 24,2002 (Paper No. 11).

THE REJECTION

Claim 1 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Howald.

Attention is directed to the main and reply briefs (Paper Nos. 23 and 26) and the answer (Paper No. 24) for the respective positions of the appellants and the examiner regarding the merits of this rejection. [FN1]

DISCUSSION

*2 As framed and argued by the appellants, the dispositive issue in the appeal is whether Howald would have rendered obvious within the meaning of § 103(a) a component meeting the limitation in claim 1 requiring that "a ratio of the cross-sectional area of the hot-side orifice of the at least one component cooling passage to the cross-sectional area of the cold-side orifice of the at least one component cooling passage is less than 1.2." The appellants do not dispute the examiner's assessment that Howald teaches, or would have suggested, a component meeting the remaining limitations in the claim. Of the ratio in question, the appellants' specification states that

[i]t proves to be favorable if the discharge cross section of the cooling passage is less than 120% of the inlet cross section, this on the one hand for production reasons, so that the variation in the power density of the cutting beam over the material thickness to be penetrated is kept within practible limits, and in or-

der not require too short a focal width of the collimating optics used [page 8].

The following passage from the Howald reference fairly summarizes the component disclosed therein:

[b]riefly and in its broader aspects the inventionis characterized by a structural member, the "outer" surface of which defines a flow path for a hot gas stream moving there past at a relatively high velocity. The opposite surface of this member defines, at least in part, a chamber. Means are provided for pressurizing a coolant, preferably air, within this chamber to a pressure somewhat greater than the static pressure of the gas stream flowing there past. Discrete holes [44] are provided through the member so that the coolant may flow from the pressurized chamber to the "outer" surface thereof [column 2, lines 37 through 47].

Howald teaches that "[m]any interrelated factors contribute to the effectiveness of the holes 44 in providing the desired cooling action" (column 5, lines 6 and 7). The factors discussed include the cross-sectional shape of the holes, the diameter of the holes, the angular disposition of the holes relative to the outer surface, the arrangement of the holes on the outer surface, the included angle of the holes, and the length to diameter ratio of the holes (see, for example, column 2, line 53, through column 3, line 15; column 5, lines 7 through 18 and 62 through 68; and column 6, lines 14 through 24).

Although Howald does not mention the ratio of the cross-sectional areas of the hot-side and cold-side orifices as a factor contributing to the effectiveness of the coolant holes, the examiner submits that

[s]ince the originally filed disclosure of the instant application fails to even mention any criticality associated with the claimed range for the abovementioned ratio of areas, it is reiterated that it would not have been inventive to discover the optimum range or another workable range for the above mentioned ratio of areas by routine experimentation. ...

*3 It would thus have been obvious at the time of the invention to perform routine experimentation in order to optimize the relative areas of the hot-side orifice and the cold-side orifice of Howald to a particular range of values, even to the range of between 1 and 1.2 as claimed by appellants in the instant application, in order to optimize the performance of the structural members or buckets being cooled while achieving particular desired levels of entrainment of cooling within the hot gas boundary layer, for example [answer, page 5].

The examiner's conclusion of obviousness ostensibly rests on the well established principle that the discovery of an optimum value of a variable in a known process is normally obvious, with exceptions occurring where the parameter optimized was not recognized to be a result effective variable or where the results of optimizing a known result effective variable were unexpectedly good. In re Antonie, 559 F.2d 618, 620, 195 USPQ 6, 8-9 (CCPA 1977).

In the present case, it is true that the ratio of the cross-sectional areas of the hot-side and cold-side orifices depends on some of the cooling effectiveness factors, e.g., length and included angle of the hole, mentioned by Howald. Moreover,

one of ordinary skill in the art would have expected that changes in these factors made to achieve a desired level of cooling effectiveness would produce corresponding changes in the ratio of the cross-sectional areas of the hot-side and cold-side orifices. Howald, however, does not even mention this ratio, let alone attach any importance thereto, in connection with the design of the coolant holes, and certainly does not contemplate the specific manufacturing advantage disclosed by the appellants for ratios less than 1.2. Thus, in the absence of impermissible hindsight, Howald does not justify the examiner's implicit conclusion that the ratio of the cross-sectional areas of the hot-side and cold-side orifices is an art-recognized result effective variable relative to cooling effectiveness. Hence, Howald fails to establish a prima facie case of obviousness with respect to the subject matter recited in claim 1. [FN2] Accordingly, we shall not sustain the standing 35 U.S.C. § 103(a) rejection of this claim.

SUMMARY

The decision of the examiner to reject claim 1 is reversed.

REVERSED

BOARD OF PATENT APPEALS AND INTERFERENCES

CHARLES E. FRANKFORT

Administrative Patent Judge

LAWRENCE J. STAAB

Administrative Patent Judge

JOHN P. MCQUADE

Administrative Patent Judge Application No. 09/431,178

FN1. In the answer (see page 6), the examiner asserts that the orifices of the instant application (and presumably those set forth in claim 1) are inherently elliptical. This assertion appears to be based on an assumption that the cooling passage orifices are disposed on the airfoil of a turbine blade. Claim 1, however, is not so limited. The underlying specification describes the turbine blade shown in the drawings merely as an example of the sort of component addressed by the appellants, and indicates that portions of the exemplary turbine blade other than the airfoil, such as the blade platform, may contain cooling passages.

FN2. This being so, it is unnecessary to delve into the merits of the appellants' evidence of non-obviousness.

GJH

Appeal No. 2004-1622

Application No. 09/431,178

*4 APJ MCQUADE

APJ STAAB

APJ FRANKFORT

REVERSED

September 15, 2005

2004 WL 4983375 (Bd.Pat.App & Interf.)

END OF DOCUMENT

2004 WL 4972873 (Bd.Pat.App & Interf.)
(Cite as: 2004 WL 4972873 (Bd.Pat.App & Interf.))

*1 THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

Board of Patent Appeals and Interferences

Patent and Trademark Office (P.T.O.)
EX PARTE DAVID DORNFELD AND JIANSHE TANG
Appeal No. 2002-1029
Application No. 08/869,328
September 30, 2004

J. Georg Seka

Townsend and Townsend and Crew

Two Embarcadero Center

8th Floor

San Francisco, CA 94111

Before FRANKFORT, PATE and McQUADE

Administrative Patent Judges

PATE

Administrative Patent Judge

ON BRIEF

DECISION ON APPEAL

This is an appeal from the final rejection of claims 1, 4, 6, 7, 9 through 15, 17 through 25, and 36 through 40. Claims 2, 3, 5, 8, 16, and 26 through 35 are cancelled. These are all the claims in the application.

The claimed invention is directed to a chemicalmechanical planarization of semiconductor wafers. The claimed process is related to a method of terminating such a planarization. The present invention involves monitoring acoustic emission energy with a frequency of over 50,000 Hertz for a planarization termination signal.

The claimed invention may be further understood with reference to the appealed claims attached as an appendix to appellant's Supplemental Appeal Brief, Paper No. 28.

The references of record relied upon by the examiner as evidence of obviousness are:

Yu	5,222,329	June 29, 1993
Salugsugan	5,245,794	Sept. 21, 1993

REJECTION

Claims 1, 4, 6, 7, 9 through 15, 17 through 25, and 36 through 40 stand rejected under 35 U.S.C. § 103 as unpatentable over Yu in view of Salugsugan. According to the examiner, it would have been obvious to have modified the Yu apparatus and method with a filter as taught by Salugsugan to halt the polisher operation. The examiner considers the specific frequency range of the claimed subject matter to be a result effective variable.

OPINION

We have carefully reviewed the rejection on appeal in light of the arguments of the appellants and the examiner. As a result of this review, we have reached the determination that the applied prior art does not establish the prima facie obviousness of the claims on appeal. Our reasons follow.

The following represents our findings of fact with respect to the scope and content of the prior art and the differences between the prior art and the claimed subject matter. Yu discloses a method for controlling a chemical-mechanical polishing operation on a workpiece comprising the steps of polishing the workpiece with a slurry of abrasives. The polishing operation generates acoustic energy emissions which are detected. The sound intensity versus the frequency of the acoustic emission is measured. Col. 6, lines 3-5. When a significant change in the sound frequency and amplitude is detected, the end point of polishing has been reached. Yu teaches several frequency ranges for his disclosed process. On the one hand, Yu suggests monitoring frequencies in the audible range (approximately 20 Hz to 20,000 Hz) using a microphone as a transducer. However, Yu also discloses using acoustic energy in the non-audible range (less than 20 Hz or greater than 20,000 Hz). See col. 6, lines 48-51; col. 4, lines 48-53. For frequencies above 20,000 Hz, Yu states that a contact transducer, such as a piezoelectric transducer, may be used in lieu of the microphone. Id. Yu does not specifically disclose detecting acoustic emissions at frequencies above 50,000 Hz.

*2 Salugsugan discloses a similar process. However, Salugsugan uses low frequencies to signal the end of polishing, specifying a low band pass filter to attenuate frequencies above 200 Hz by at least 60 db. Consequently, Salugsugan does not disclose frequencies above 50,000 Hz.

The examiner is of the view that with respect to the frequency range above 50,000 Hz, "the values of the mechanical properties are obvious because they are a matter of determining optimum conditions by routine experimentation. Discovery of [an] optimum value of [a] result effective variable in [a] known process is ordinarily within the skill in the art." See Examiner's Answer, page 4. The examiner cites In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). However, in Boesch, it was held

that "optimizing a variable which was known to be result effective" was within the ordinary skill in the art (emphasis supplied). Boesch, 617 F.2d at 276, 205 USPQ at 219, quoting In re Antonie, 559 F.2d 618, 620, 195 USPQ 6, 8-9 (CCPA 1977). Thus, under such a scenario, the examiner has a burden of establishing that the prior art recognizes that the variable is result effective.

In the present case, the patent to Yu merely discloses sampling acoustic energy in a range above 20,000 Hz. There is no disclosure that any frequency affects the sensitivity of the process cutoff or that any frequency above 20,000 Hz is better than any other frequency. In fact, Yu discloses nothing other than frequencies above 20,000 Hz may be used. There is certainly no disclosure that frequency is a variable that can be optimized to effect a result. Accordingly, in our view, the prior art taken as a whole, as combined by the examiner, is merely an invitation to experiment -- an example of obvious to try.

An "obvious-to-try" situation exists when a general disclosure may pique the scientist's curiosity, such that further investigation might be done as a result of the disclosure, but the disclosure itself does not contain a sufficient teaching of how to obtain the desired result, or that the claimed result would be obtained if certain directions were pursued. See generally In re O'Farrell, 853 F.2d 894, 903, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988) (defining obvious-totry as when prior art gives "only general guidance as to the particular form of the claimed invention or how to achieve it") [In re Eli Lilly & Co., 902 F.2d 943, 945, 14 USPQ2d 1741, 1743 (Fed. Cir. 1990)].

The rejection of all claims on appeal is reversed.

REVERSED

BOARD OF PATENT APPEALS AND INTERFERENCES

CHARLES E. FRANKFORT

*3 Administrative Patent Judge

WILLIAM F. PATE, III

Administrative Patent Judge

JOHN P. McQUADE

Administrative Patent Judge

2004 WL 4972873 (Bd.Pat.App & Interf.)

END OF DOCUMENT

2006 WL 2523874 (Bd.Pat.App & Interf.)
(Cite as: 2006 WL 2523874 (Bd.Pat.App & Interf.))

*1 THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

Board of Patent Appeals and Interferences

Patent and Trademark Office (P.T.O.)
EX PARTE BRUCE A. CORNELL AND RONALD J. PACE
Appeal No. 2001-0059
Application No. 08/530,370
December 23, 2002

Nixon & Vanderhye

1100 North Glebe Road 8th Floor

Arlington, VA 22201-4714

Before WILLIAM F. SMITH, SCHEINER and MILLS

Administrative Patent Judges

SCHEINER

Administrative Patent Judge

ON BRIEF

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 from the final rejection of claims 1-11, the only claims in the application.

Claim 1 is representative of the subject matter on appeal and reads as follows:

1. A membrane for use in detecting the presence of an analyte, the membrane comprising an array of closely packed self-assembling amphiphilic molecules and a plurality of first and second receptor molecules, the first receptor molecules being reactive with one site on the analyte and second receptor molecules being reactive with another site on the analyte, the first receptor molecules being prevented from lateral diffusion within the membrane whilst the second receptor molecules are free to diffuse laterally within the membrane, the membrane being characterized in that the ratio of first receptor molecules to second receptor molecules is 10:1 or greater.

The references relied on by the examiner are:

Miyazaki et al. (Miyazaki)	5,229,302	Jul. 20, 1993
Cornell et al. (Cornell I)	5,443,955	Aug. 22, 1995

Cornell et al. (Cornell II) WO 90/08783 Aug. 9, 1990

Claims 1-10 stand rejected under 35 U.S.C. § 103 as unpatentable over Cornell II; claim 11 stands rejected under 35 U.S.C. § 103 as unpatentable over Cornell II and Miyazaki; while claims 1-7 and 9 stand rejected under the doctrine of obviousness-type double patenting as unpatentable over claims 1-25 of U.S. Patent No. 5,443,955 (Cornell I).

We reverse all three of the examiner's rejections.

DISCUSSION

Obviousness

The examiner has rejected claims 1-10 as obvious over Cornell II, and claim 11 as obvious over Cornell II and Miyazaki. Claim 1, which represents the invention in its broadest aspect, is directed to an analytical membrane comprising an array of closely packed self-assembling amphiphilic molecules and a plurality of first and second receptor molecules reactive with two different sites on an analyte. The first receptor molecules are "prevented from lateral diffusion within the membrane whilst the second receptor molecules are free to diffuse laterally within the membrane," and the claim requires that "the ratio of first receptor molecules to second receptor molecules is 10:1 or greater."

*2 Cornell II describes membranes that meet all of the limitations of claim 1 except for the specified ratio. According to the examiner, however, one skilled in the art would have been "motivat[ed] to optimize the ratio of first receptor molecules to second receptor molecules" in the manner required by the claims because Cornell II teaches that "the density of receptor molecules in the membrane can be controlled and hence optimized for the most sensitive detection of the desired analyte." Answer, page 7. We disagree with the examiner's conclusion.

While we agree with the examiner that "discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art," In re Boesch, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980) (citations omitted), our reviewing court has found an exception to this general rule where "the parameter optimized was not recognized to be a result effective variable," In re Antonie, 559 F.2d 618, 621, 195 USPQ 6, 8 (CCPA 1977).

In our view, the examiner has not established that one skilled in the art would have recognized the ratio of first receptor molecules to second receptor molecules as a result effective variable. In other words, the examiner has not identified anything in Cornell II which would have led one skilled in the art to recognize or expect that manipulating the relative proportions of first and second receptor molecules within the membrane (as opposed to altering the overall density of receptor molecules in the membrane) would affect the performance of the membrane.

As explained in In re Kotzab, 217 F.3d 1365, 1369-70, 55 USPQ2d 1313, 1316 (Fed.

Cir. 2000):

A critical step in analyzing the patentability of claims pursuant to section 103(a) is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. [ ] Close adherence to this methodology is especially important in cases where the very ease with which the invention can be understood may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the invention taught is used against its teacher." [ ]

We have no doubt that the prior art could be modified in a manner consistent with appellants' specification and claims. The fact that the prior art could be so modified, however, would not have made the modification obvious unless the prior art suggested the desirability of the modification. In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984). Here, we find no reason stemming from the prior art relied on by the examiner which would have led a person having ordinary skill in the art to the claimed invention. Miyazaki is cited in the rejection of dependent claim 11 for its description of a fluorescence-based immunoassay, but does nothing to cure the underlying deficiencies of Cornell II's teachings. In our judgment, the only reason or suggestion to modify Cornell II in the manner proposed by the examiner comes from appellants' specification.

*3 Finally, we know of no basis for the examiner's requirement that appellants establish that "the only intent of the inventors of [Cornell II] was to alter the overall amount of antibody and not the individual antibody amounts." Answer, page 10.

On this record, we are constrained to reverse both of the examiner's rejections of the claims under 35 U.S.C. § 103.

Double Patenting

Claims 1-7 and 9 stand rejected under the doctrine of obviousness-type double patenting as unpatentable over claims 1-25 of Cornell I (U.S. Patent No. 5,443,955). The patented claims are directed to analytical membranes that meet all of the limitations of claim 1 on appeal except for the specified ratio. Again, the examiner concluded that one skilled in the art would have been "motivat[ed] to optimize the ratio of first receptor molecules to second receptor molecules" in the manner required by the claims on appeal because Cornell I teaches (at column 9, lines 1-3) that "the density of receptor molecules in the membrane can be controlled and hence optimized for the most sensitive detection of the desired analyte." Answer, page 4.

Again, we disagree with the examiner's conclusion for the reasons discussed above in our analysis of the rejections under 35 U.S.C. § 103. In addition, we remind the examiner that a finding of double patenting should be based on the claims of an application or patent; the teachings of the specification of the application or patent may only be used for certain, limited purposes - and not as prior art. See, e.g., In re Vogel, 422 F.2d 438, 441-42, 164 USPQ 619, 622 (CCPA 1970).

The rejection of claims 1-7 and 9 under the doctrine of obviousness-type double

patenting is reversed.

REVERSED

BOARD OF PATENT APPEALS AND INTERFERENCES

William F. Smith

Administrative Patent Judge

Toni R. Scheiner

Administrative Patent Judge

Demetra J. Mills

Administrative Patent Judge

2006 WL 2523874 (Bd.Pat.App & Interf.)

END OF DOCUMENT

2001 WL 1057283 (Bd.Pat.App & Interf.)
(Cite as: 2001 WL 1057283 (Bd.Pat.App & Interf.))

H

*1

Board of Patent Appeals and Interferences

Patent and Trademark Office (P.T.O.)
EX PARTE DEAN L. SICKING, JOHN D. REID, RONALD K. FALLER, BRIAN G. PFEIFER, BARRY T. ROSSON AND JOHN R. ROHDE
Appeal No. 2000-0523
Application 08/583,307

NO DATE REFERENCE AVAILABLE FOR THIS DOCUMENT

VINCENT L. CARNEY

P.O. BOX 80836

LINCOLN, NE 68501-0836

Before CALVERT, FRANKFORT and McQUADE

Administrative Patent Judges.

McQUADE

Administrative Patent Judge.

ON BRIEF

DECISION ON APPEAL

Dean L. Sicking et al. appeal from the final rejection of claims 1 through 17, all of the claims pending in the application. We reverse.

THE INVENTION

The invention relates to a roadway guardrail barrier having an effective depth or capture area intended to receive the moving vehicle in a recessed portion of the guardrail barrier bounded by upper and lower curved portions projecting toward the roadway to stabilize the vehicle and reduce the tendency for the vehicle to vault over or dive under the barrier or to roll when redirected by holding the vehicle against upward and downward motion [specification, page 1].

Claim 1 is illustrative and reads as follows:

1. A guardrail barrier that balances moment of inertia and membrane effect without requiring more material to reduce the tendency of high center of mass vehicles from turning over comprising:

outer curves;

a central portion between said outer curves;
the central portion and outer curves being positioned to provide an effective depth of between 9 to 15 inches.

THE PRIOR ART

The references relied upon by the examiner as evidence of anticipation and obviousness are:

Martin et al. (Martin)	2,536,760	Jan. 2, 1951
Brown et al. (Brown)	3,214,142	Oct. 26, 1965

THE REJECTIONS

Claims 1 through 17 stand rejected under 35 U.S.C. § 112, second paragraph, as failing to particularly point out and distinctly claim the subject matter the appellants regard as the invention.

Claims 1 through 12 and 14 through 17 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Brown, and in the alternative under 35 U.S.C. § 103 as being obvious over Brown.

Claim 13 stands rejected under 35 U.S.C. § 103 as being obvious over Brown.

Claims 1 through 17 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Martin, and in the alternative under 35 U.S.C. § 103 as being obvious over Martin.

*2 Attention is directed to the appellants' brief (Paper No. 17) and to the examiner's answer (Paper No. 18) for the respective positions of the appellants and the examiner with regard to the merits of these rejections.

DISCUSSION

I. The 35 U.S.C. § 112, second paragraph, rejection

The second paragraph of 35 U.S.C. § 112 requires claims to set out and circumscribe a particular area with a reasonable degree of precision and particularity. In re Johnson, 558 F.2d 1008, 1015, 194 USPQ 187, 193 (CCPA 1977). In determining whether this standard is met, the definiteness of the language employed in the claims must be analyzed, not in a vacuum, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art. Id.

The examiner considers appealed claims 1 through 17 to be indefinite because they "are generally narrative in form and replete with indefinite and functional or operational language" (answer, page 3). The stated reasoning for this determination,

which indicates that the examiner's "generally narrative" concern stems from the so-called functional or operational language, is that:

The following terms or phrases in claims 1-17 are not self-explanatory and are not defined in the claims such that their physical association with the structure of the guardrail system is understood: effective depth, length of the edge, area of the edge, crush strength, depth, width, length, Xbar, Ybar, Ix, Sx, Sy1, Sy2, surface contact, C-max, bearing area, and total bearing area.

In claim 2, the functional recitation that the guardrail system is "tailored to ... occupant compartment" is indefinite because it is not supported by recitation in the claim of sufficient structure to accomplish the function. Likewise, in claim 8, the functional recitation that the "occupant compartment is not intruded upon" is indefinite because it is not supported by recitation in the claim of sufficient structure to accomplish the function.

In claims 9 and 10, it is unclear if the phrases "an effective depth," "an area edge [sic, edge area]," and "a moment of inertia" are referencing the effective depth, area edge, and moment of inertia previously recited in claims 1 and 2. Also, it is unclear as to the meaning of "first and second set of characteristics" of claim 9 [answer, pages 3 and 4].

While admitting that the terms or phrases listed in the first paragraph of this passage are defined in (or at least understandable in light of) the underlying specification, the examiner submits that the use of the specification to interpret these terms or phrases amounts to an improper reading of the specification into the claims (see pages 6 and 7 in the answer). It is well settled, however, that it is entirely proper to use the specification to interpret what is meant by a word or phrase in a claim, and that this is not to be confused with the improper addition of an extraneous limitation from the specification wholly apart from any need to interpret the word or phrase. In re Paulsen, 30 F.3d 1475, 1480, 31 USPQ2d 1671, 1674 (Fed. Cir. 1994). Here, the use of the appellants' admittedly enlightening specification to interpret the claim language in question is entirely proper and does not amount to an improper reading of limitations into the claims.

*3 The examiner's criticism of claims 2 and 8 as being indefinite simply because the functional limitations therein are not supported by a corresponding recitation of structure is also unsound. There is nothing intrinsically wrong with defining something by what it does rather than by what it is. In re Hallman, 655 F.2d 212, 215, 210 USPQ 609, 611 (CCPA 1981); In re Swinehart, 439 F.2d 210, 213, 169 USPQ 226, 228 (CCPA 1971).

As for examiner's comments relating to claims 9 and 10, the phrases at issue clearly refer back to the corresponding phrases in parent claims 1 and 2, and the meaning of the first and second set of characteristics recited in claim 9 is readily apparent given the detailed definition thereof in the claim.

Thus, the examiner's position that the subject matter recited in claims 1 through 17 is indefinite is not well founded. [FN1] Accordingly, we shall not sustain the standing 35 U.S.C. § 112, second paragraph, rejection of these claims.

II. The 35 U.S.C. § 102(b) and § 103 rejections

Brown and Martin, the references applied in support of the prior art rejections, disclose W-beam guardrail barriers.

The Brown barrier, which is shown in Figures 5 through 7 of the reference, consists of elongated metal elements, each of which is so configured as to form a deep longitudinal corrugation 1 at one edge and a similar deep longitudinal corrugation 2 at the other edge. Between these corrugations there is a flat area indicated at 3. If desired, the extreme edges of the barrier elements may be turned inwardly as indicated at 4 and 5 in FIGS. 5 and 6 [column 2, lines 17 through 24].

The Martin barrier consists of a rail 12 formed of a plurality of interconnected members 14. These members 14 are of a corrugated form and have an angular or re-entrant cross-sectional shape. As shown in the drawing[s] the members 14 have two vertically spaced corrugations 15 and 16 therein which form continuous longitudinal ribs 15a and 16a on the traffic side of the rail. The corrugations 15 and 16 are connected by an intermediate web portion 17 which forms a continuous longitudinal flat face 17a on the rail [column 2, lines 39 through 48].

Claim 1, the sole independent claim on appeal, recites a guardrail barrier comprising outer curves and a central portion positioned to provide "an effective depth of between 9 to 15 inches." [FN2] The appellants' specification indicates that an effective depth in this range contributes to the safety of the guardrail barrier.

The examiner has rejected claim 1 under 35 U.S.C. § 102(b) as being anticipated by each of Brown and Martin, and in the alternative under 35 U.S.C. § 103 as being obvious over each of Brown and Martin.

*4 The rationale for the anticipation rejections (see pages 4 and 5 in the answer) seems to be that since each reference discloses a barrier having outer curves and a central portion, the various parameters recited in the claims (presumably including the effective depth parameter recited in claim 1) are inherent in the respective prior art structures.

As for the obviousness rejections, the examiner, allowing for the possibility that the recited parameters might not be inherent in the Brown and Martin barriers, has concluded that it would have been obvious "to choose to design within the claimed ranges as the use of optimum or workable ranges discovered by routine experimentation is ordinarily within the skill of the art" (answer, pages 4 and 5).

Neither Brown nor Martin expressly discloses any specific effective depth figure, much less one falling within the claimed range. Indeed, neither reference even mentions guardrail barrier effective depth. Simply put, Brown and Martin are completely devoid of any factual basis supporting the examiner's determination that the barriers disclosed therein inherently have an effective depth meeting the particular range recited in claim 1.

Brown and Martin are also devoid of any factual basis supporting the examiner's conclusion that the effective depth specified in claim 1 would have been obvious as a matter of routine experimentation. While the discovery of an optimum value of a variable in a known process (or product) is normally obvious, exceptions lie where the results of optimizing the variable are unexpectedly good or where the parameter optimized was not recognized to be a result-effective variable. In re Antonie, 559 F.2d 618, 620, 195 USPQ 6, 8- 9 (CCPA 1977). Here, neither Brown nor Martin provides any hint that the effective depth of the guardrail barriers respectively disclosed therein is an art recognized result-effective variable. In this light, it is evident that the examiner's conclusion of obviousness with respect to the subject matter recited in claim 1 rests on impermissible hindsight knowledge.

Accordingly, we shall not sustain:

a) the standing 35 U.S.C. § 102(b) rejection of claim 1, and of dependent claims 2 through 12 and 14 through 17, as being anticipated by Brown;

b) the standing 35 U.S.C. § 103 rejection of claim 1, and of dependent claims 2 through 12 and 14 through 17, as being obvious over Brown;

c) the standing 35 U.S.C. § 103 rejection of dependent claim 13 as being obvious over Brown.

d) the standing 35 U.S.C. § 102(b) rejection of claim 1, and of dependent claims 2 through 17, as being anticipated by Martin; or

e) the standing 35 U.S.C. § 103 rejection of claim 1, and of dependent claims 2 through 17, as being obvious over Martin.

SUMMARY

*5 The decision of the examiner to reject claims 1 through 17 is reversed.

REVERSED

BOARD OF PATENT APPEALS AND INTERFERENCES

IAN A. CALVERT

Administrative Patent Judge

CHARLES E. FRANKFORT

Administrative Patent Judge

JOHN P. McQUADE

Administrative Patent Judge

FN1. Although not indefinite, the claims might be easier to understand, even when read in light of the specification, if amended to: define the "edge" recited in claims 2, 3 and 9 as the --cross-sectional-- edge; define the "area" in the second set of claim 9 and in claim 10 as the --cross-sectional edge-area; define the "length" recited in claim 10 as the --crosssectional edge-- length; define the "edges" recited in claim 11 and the "edge" recited in claim 13 as the --end--

edge(s); and modify the second clause in claim 13 by changing "opening" to --openings-- and "sections" (second occurrence) to -- openings--. In addition, the appellants may wish to review claim 17 with an eye toward resolving any inconsistency between the recitation of individual bearing areas of 0.079 square inches and a total bearing area of at least 5.6 square inches (also see pages 7, 8 and 17 in the specification).

FN2. The effective depth of the guardrail barrier is measured "from the centerline of the uppermost curved portion of the barrier (horizontal radius) to the centerline of the lowermost curved portion (horizontal radius)" (appellants' specification, page 2).

2001 WL 1057283 (Bd.Pat.App & Interf.)

END OF DOCUMENT

2001 WL 1149824 (Bd.Pat.App & Interf.)
(Cite as: 2001 WL 1149824 (Bd.Pat.App & Interf.))

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Board of Patent Appeals and Interferences

Patent and Trademark Office (P.T.O.)
EX PARTE LEE F. NIKKEL AND EUGENE H. SCHMIDT
Appeal No. 1999-1718
Application 08/786,742

NO DATE REFERENCE AVAILABLE FOR THIS DOCUMENT

GREER, BURNS & CRAIN, LTD

STE. 8660 SEARS TOWER

233 SOUTH WACKER DRIVE

CHICAGO, IL 60606

Before ABRAMS, McQUADE and GONZALES

Administrative Patent Judges

McQUADE

Administrative Patent Judge

ON BRIEF

DECISION ON APPEAL

Lee F. Nikkel et al. appeal from the final rejection of claims 1 through 9, 11 through 14, 16 through 19 and 21, all of the claims pending in the application. We reverse.

THE INVENTION

The invention relates to a "row crop debris clearing apparatus for agricultural usage" (specification, page 1). Claim 1 is illustrative and reads as follows: [FN1]

1. Apparatus for use with a farm implement for clearing debris from a path in a field during forward movement of the farming implement, said apparatus comprising:
a frame structure having a support;
a pair of rotatable clearing disks, each having an inward and outward side, each disk having a generally circular outer shape, a generally concave outward side surface and a plurality of backswept notches in its outer periphery;
a pair of disk mounts for attaching said pair of clearing disks to said support, said disk mounts being oriented to position each of said pair of disks to converge

adjacent one another at the forward reach of said disks, the rearward reach of said disks being spaced apart from one another so that the general planes of the disks are angled outwardly from the forward reach to the rearward reach thereof;

said inward side of each of said rotatable clearing disks being attached to one of said disk mounts;

the forward reach of one of said clearing disks being spaced between about 3 and about 10 inches from the forward reach of the other of said clearing disks in a direction along said path; and

a mounting means for attaching said apparatus to the farm implement.

THE PRIOR ART

The references relied upon by the examiner as evidence of obviousness are:

Carney	2,698,565	Jan. 4, 1955
Williams et al. (Williams)	4,425,973	Jan. 17, 1984
White	4,431,061	Feb. 14, 1984
Groff	5,497,836	Mar. 12, 1996

THE REJECTIONS

Claims 1, 3, 5, 7 and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Williams.

Claim 2 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Williams in view of White.

*2 Claim 4 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Williams in view of Carney.

Claims 6, 8, 9, 12 through 14, 16 through 19 and 21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Williams in view of Groff.

Attention is directed to the appellants' main and reply briefs (Paper Nos. 10 and 12) and to the examiner's answer (Paper No. 11) for the respective positions of the appellants and the examiner with regard to the merits of these rejections.

DISCUSSION

Williams, the examiner's primary reference, discloses a debris clearing apparatus of the sort recited in the appealed claims. The apparatus includes a pair of notched clearing discs 112 having respective forward reaches which, as shown in Figure 3, are spaced from one another in a path clearing direction. Williams, however, gives no indication as to the magnitude of this spacing. Thus, as conceded by the examiner (see pages 4, 8 through 10 and 16 in the answer), Williams does not meet the limitation in independent claim 1 requiring "the forward reach of one of said clearing disks being spaced between about 3 and about 10 inches from the forward reach of the

other of said clearing disks in a direction along said path," or the substantively corresponding limitations in independent claims 11 and 16. [FN2] The appellants explain in the underlying specification (see pages 2 and 6), and recite to some extent in claims 11 and 16, that the specified spacing range minimizes the possibility that the disks will interfere with one another by engaging a single item of debris at the same time which could cause the debris to remain in the path and/or plug up the apparatus.

Notwithstanding the foregoing deficiency in Williams, the examiner has concluded that

> it would have been obvious to one having ordinary skill in the art at the time the invention was made ... to provide a distance of between 3 and 10 inches between the forward reaches of the [Williams] disks, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233 [answer, page 4].

Along these lines, the examiner stresses that "appellants have not provided any proof that the range is critical, or provided evidence that the claimed range provides new and unexpected results" (answer, page 16).

The examiner's reliance on In re Aller, 220 F.2d 454, 105 USPQ 233 (CCPA 1955) to support the appealed rejections is not well taken.

Aller stands for the principle that the discovery of an optimum value of a variable in a known process is normally obvious. In re Antonie, 559 F.2d 618, 620, 195 USPQ 6, 8-9 (CCPA 1977). Exceptions to this general rule lie in cases where the results of optimizing a variable, which was known to be result effective, were unexpectedly good or where the parameter optimized was not recognized to be a result-effective variable. Id.

*3 The record in the present case shows that the appellants recognized the spacing between the forward reaches of a pair of clearing disks in a debris clearing apparatus of the type claimed to be a result-effective variable bearing on the performance of the apparatus, with the about 3 to about 10 inch range specified in the claims minimizing the possibility of operative interference between the disks. There is nothing in Williams, considered alone or in any combination with White, Carney and/or Groff, which demonstrates that this recognition was shared by the prior art. In other words, the applied references do not establish that the spacing between the forward reaches of a pair of clearing disks in a debris clearing apparatus of the type claimed was an art-recognized result-effective variable. This fact situation falls into one of the exceptions to the general rule established by Aller, and it matters not that the record is lacking in proof that the claimed spacing range is critical or provides new and unexpected results.

Thus, the applied references fail to justify the examiner's conclusion that the differences between the subject matter recited in independent claims 1, 11 and 16, and in dependent claims 2 through 9, 12 through 14, 17 through 19 and 21, are such that the subject matter as a whole would have been obvious at the time the invention

was made to a person having ordinary skill in the art. Therefore, we shall not sustain any of the standing 35 U.S.C. § 103(a) rejections of these claims.

The decision of the examiner is reversed.

REVERSED

BOARD OF PATENT APPEALS AND INTERFERENCES

NEAL E. ABRAMS

Administrative Patent Judge

JOHN P. McQUADE

Administrative Patent Judge

JOHN F. GONZALES

Administrative Patent Judge

FN1. The following informalities are deserving of correction in the event of further prosecution before the examiner: in claim 2, the recitation that the "support" comprises a "shank" conflicts with the underlying specification (see page 5) which describes the two as separate elements; in claims 11 and 16, the term "said disk mounts" lacks a proper antecedent basis and there is a double recitation of the clearing disks; and in claim 21, the specified claim dependency is from canceled claim 20.

FN2. The examiner's alternate position that "Williams et al. as shown in figure 3, appears to show the forward reach of one disk spaced about 3 inches from the forward reach of the other disk" (answer, page 13) is completely unfounded.

2001 WL 1149824 (Bd.Pat.App & Interf.)

END OF DOCUMENT

2001 WL 1339925 (Bd.Pat.App & Interf.)
(Cite as: 2001 WL 1339925 (Bd.Pat.App & Interf.))

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Board of Patent Appeals and Interferences

Patent and Trademark Office (P.T.O.)
EX PARTE JIH-PING PENG
Appeal No. 1999-0037
Application No. 08/611,657

NO DATE REFERENCE AVAILABLE FOR THIS DOCUMENT

WESTMAN, CHAMPLIN & KELLY

INTERNATIONAL CENTRE

900 SECOND AVENUE SOUTH

SUITE 1600

MINNEAPOLIS, MN 55402-3319

Before HAIRSTON, BARRY, and BLANKENSHIP

Administrative Patent Judges.

BARRY

Administrative Patent Judge.

ON BRIEF

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the rejection of claim 15. We reverse.

BACKGROUND

The invention at issue in this appeal relates to disc drives. A disc drive includes rigid discs mounted on a spindle motor that causes the discs to spin and the surfaces of the discs to pass under respective head gimbal assemblies (HGAs). HGAs carry transducers that write data to and read data from the surfaces of the discs. An HGA includes a hydrodynamic (e.g., air) bearing slider and a gimbal. The gimbal provides a resilient connection that allows the slider to pitch and roll while following the topography of the disc.

A conventional "catamaran" slider includes a pair of raised side rails that face the surface of the disc and form air bearing surfaces. As the disc rotates, the disc

drags air under the slider along the air bearing surfaces. As the air passes beneath the side rails, skin friction on the air bearing surfaces causes the air pressure between the disc and the air bearing surfaces to increase which creates a hydrodynamic lifting force that causes the slider to lift and fly above the surface of the disc.

The appellant's slider features a slider body with a leading edge, a trailing edge, and a length measured from the leading edge to the trailing edge. First and second longitudinal bearing surfaces are positioned on the slider body and feature a leading portion, a trailing portion, and a waist portion. The waist portion of at least one bearing surface is wider than the leading and trailing portions and has a maximum width at a position that is between 1/3 and 2/3 the length of the slider body.

Claim 15 follows:

15. A disc drive comprising:

a housing;

a rigid disc mounted in the housing for rotation about a central axis, the disc having a recording surface;

a rotary track accessing arm supported over the recording surface; and

a slider carried by the track accessing arm for communication with the recording surface, the slider comprising:

a slider body having a leading edge, a trailing edge and a length measured from the leading edge to the trailing edge;

first and second longitudinal bearing surfaces positioned on the slider body which have a shape that concentrates positive pressure, which is developed between the bearing surfaces and the recording surface as the recording surface rotates about the central axis, between 1/3 to 2/3 the length of the slider body;

*2 a shallow recessed area positioned between the first and second bearing surfaces; and

a third longitudinal bearing surface positioned within the shallow recessed area between the first and second longitudinal bearing surfaces and extending between the leading and trailing edges.

The reference relied on in rejecting the claims follows:

Read-Rite, European Patent Application 0600348A2, June 8, 1994.

Claim 15 stands rejected under 35 U.S.C. § 103(a) as obvious over Read-Rite. Rather than repeat the arguments of the appellant or examiner in toto, we refer the reader to the brief and answer for the respective details thereof.

OPINION

In deciding this appeal, we considered the subject matter on appeal and the rejection advanced by the examiner. Furthermore, we duly considered the arguments and evidence of the appellant and examiner. After considering the record, we are persuaded that the examiner erred in rejecting claim 15. Accordingly, we reverse.

We begin by noting the following principles from In re Rijckaert, 9 F.3d 1531,

1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993).

In rejecting claims under 35 U.S.C. Section 103, the examiner bears the initial burden of presenting a prima facie case of obviousness. In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992).... "A prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art." In re Bell, 991 F.2d 781, 782, 26 USPQ2d 1529, 1531 (Fed. Cir. 1993) (quoting In re Rinehart, 531 F.2d 1048, 1051, 189 USPQ 143, 147 (CCPA 1976)).
With these principles in mind, we consider the examiner's rejection and the appellants' argument.

Admitting, "Read-Rite Corporation does not specify an exact location for the waist portions (shown in Figures 4 and 5, for example)," (Examiner's Answer at 6), the examiner asserts, "[b]ecause of this, a routineer in the art would have located the waist at a position resulting from routine optimization and experimentation within the teachings of Read-Rite Corporation." (Id.) The appellants argue, "routine optimization and experimentation would not result in a slider having the structure recited in claim ... 15." (Appeal Br. at 8-9.)

"Claims are not interpreted in a vacuum, but are part of and are read in light of the specification." Slimfold Mfg. Co. v. Kinkead Indus., Inc., 810 F.2d 1113, 1116, 1 USPQ2d 1563, 1566 (Fed. Cir. 1987) (citing Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1385, 231 USPQ 81, 94-95 (Fed. Cir. 1986); In re Mattison, 509 F.2d 563, 565, 184 USPQ 484, 486 (CCPA 1975)). Here, claim 15 specifies in pertinent part the following limitations: "first and second longitudinal bearing surfaces positioned on the slider body which have a shape that concentrates positive pressure, which is developed between the bearing surfaces and the recording surface as the recording surface rotates about the central axis, between 1/3 to 2/3 the length of the slider body ...."

*3 The specification defines the limitations as follows.

Side rails 38 and 40 form longitudinal bearing surfaces 62 and 64, respectively. Bearing surfaces 62 and 64 have a leading portion 66, a waist portion 68 and a trailing portion 70. Leading portion 66 includes a leading taper 72. Leading portion 66 and trailing portion 70 have widths 74 and 76, respectively. Widths 74 and 76 may be equal to one another or different from one another. Waist portion 68 widens from leading portion 66 to a maximum width 78 and then narrows from maximum width 78 to trailing portion 70. Maximum width 78 is greater than widths 74 and 76 and is positioned at a distance 80 from leading edge 50.

...

Distance 80 is preferably between about 1/4 to 3/4, more preferably between about 1/3 to 3/4, and most preferably between about 1/3 to 1/2 the length 58 of slider 36. In these ranges, maximum width 78 is positioned about or slightly forward of the slider midpoint. Air is pressurized by leading taper 72 and then enters the wide area in waist portion 68. Most of the high pressure developed on waist portion 68 leaks along inside edge 82 before entering the narrow trailing portion 70. Therefore, more air with high pressure concentrates at the slider midpoint and does not contribute to pitch stiffness. Thus, the hydrodynamic features of slider 36 provide

a very compliant air bearing which is particularly useful for proximity recording. (Spec. at 8-9.)

Reading the claims in light of the specification, the limitations recite that the respective waists of two longitudinal bearing surfaces are wider than the leading and trailing portions of the surfaces and have a maximum width at a position between 1/3 and 2/3 the length of the associated slider body.

The examiner fails to show a suggestion of the limitations in the prior art. The U.S. Court of Customs and Patent Appeals (CCPA) established the rule that the discovery of an optimum value of a variable in a known process is normally obvious. In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). As with many rules, there are exceptions to the CCPA's rule. One exception is the case where a parameter being optimized was not recognized to be a "result-effective variable." In re Yates, 663 F.2d 1054, 1057, 211 USPQ 1149, 1151 (CCPA 1981); In re Antonie, 559 F.2d 618, 621, 195 USPQ 6, 9 (CCPA 1977). This exception applies here.

In determining whether the invention as a whole would have been obvious under § 103, we must first delineate the invention as a whole. In delineating the invention as a whole, we look to the subject matter recited in the claim and to those properties of the subject matter disclosed in the specification. Antonie, 559 F.2d at 619, 195 USPQ at 8. Here, the invention as a whole is that the respective waists of two longitudinal bearing surfaces are wider than the leading and trailing portions of the surfaces and have a maximum width at a position between 1/3 and 2/3 the length of the associated slider body. The property is that more air with high pressure concentrates at the slider's midpoint and does not contribute to pitch stiffness. (Spec. at 9.)

*4 The controlling question is simply whether the differences between the prior art and the appellant's invention as a whole viz., the positioning of the waists of the longitudinal bearing surfaces and its property, are such that the invention would have been obvious. The answer is no. The examiner has not shown that the prior art as a whole recognized that pitch stiffness depends on the positioning of the waists of longitudinal bearing surfaces. Recognition of this dependence is essential to the obviousness of conducting experiments to decide the positioning of the longitudinal bearing surfaces that will offer an acceptable pitch stiffness. The examiner gives no basis for the obviousness of the necessary experiments apart from the appellant's disclosure thereof.

For these reasons, we are not persuaded that teachings from the applied prior art would appear to have suggested the limitations of "first and second longitudinal bearing surfaces positioned on the slider body which have a shape that concentrates positive pressure, which is developed between the bearing surfaces and the recording surface as the recording surface rotates about the central axis, between 1/3 to 2/3 the length of the slider body ...." The examiner fails to establish a prima facie case of obviousness. Therefore, we reverse the rejection of claim 15 under 35 U.S.C. § 103(a) as obvious over Read-Rite.

CONCLUSION

In summary, the rejection of claim 15 under 35 U.S.C. § 103(a) is reversed.

REVERSED

BOARD OF PATENT APPEALS AND INTERFERENCES

KENNETH W. HAIRSTON

Administrative Patent Judge

LANCE LEONARD BARRY

Administrative Patent Judge

HOWARD B. BLANKENSHIP

Administrative Patent Judge

2001 WL 1339925 (Bd.Pat.App & Interf.)

END OF DOCUMENT